ONE HUNDRED YEARS OF PROGRESS

HENRY WIGGIN & COMPANY LIMITED

HISTORY OF

HENRY WIGGIN & COMPANY LTD

1835-1935

CENTENARY PUBLICATION

"History," said Professor H. E. Armstrong recently,* "can only be written by those who have made it—only then if they have sufficient command of documentary evidence." Unfortunately, the men who made the history of Henry Wiggin & Company have for the most part left little or nothing in writing, and consequently the documentary evidence available for the purpose of this publication is meagre in the extreme. The compiler of this volume and his colleagues have done what they could to surmount this serious handicap by carefully reviewing and comparing contemporary records—particularly newspaper files and the various published histories of Birmingham, its citizens and its industries, and by availing themselves of the memories of surviving members of the Wiggin family and old workmen of the firm. They are, however, very conscious of the many omissions and of the want of detail in the story, particularly in that part relating to the earlier years of the firm's activities.

The deficiencies of this account are the more to be deplored since the history of the Wiggin business, so far as the nineteenth century is concerned, is practically the history of the nickel industry in England. The technical work of the early members of the organisation contributed materially to the development of what is now becoming one of the most important branches of industrial metallurgy, and historical data of the type here presented has therefore an interest far beyond merely local connections. It is particularly unfortunate, for instance, that no records exist of the experimental work carried out by the Company during its earlier years, for this must have been exceptionally varied and difficult. Literature on the metallurgy of the extraction and refining of nickel was then practically non-existent, and the chemical principles involved were very imperfectly understood even by the few trained chemists of the day who were interested in the subject.

Many of the early investigations must of necessity have been largely empirical, but none the less even the barest record of this experimental work would be of immense technical interest if available today. It is admitted that the lack of a detailed account of the evolution of the technical processes of the works seriously detracts from the metallurgical interest of this publication, but an effort has been made to compensate this defect in some degree by giving a fairly complete summary of the methods of refining nickel and cobalt as ultimately worked out and brought to success. It should be borne in mind by the reader that the principles of the method of separating nickel and cobalt developed by Askin, one of the founders of the firm, were subsequently adopted by nickel refiners in all parts of Europe for the class of ores then available,

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* Address at the Jubilee of the City and Guilds College. Chem. and Indus. 1935, vol 54, No.6,p131.

In order to set the earlier history of the enterprise in truer perspective, some account is given in Chapter I of the conditions of life prevailing in Birmingham in 1835, when the firm was founded.

Since extracts from and allusions to historical and other publications of the period are for the most part summarised rather than given verbatim, few references are embodied in the text, but acknowledgement must be made to a number of books, journals and newspaper files, chiefly the following;

The Making of Birmingham—R. K. Dent.
Modern Birmingham ad its Institutions—J. A. Langford,
Picture of Birmingham—J. Drake,
Description of Modern Birmingham —Pye.
Pictorial Guide to Birmingham—W. Bates.
Story of Birmingham's Growth—W. Moughton.
Various Birmingham Directories of 1835 and following years
City of Birmingham Official Handbook
Birmingham Faces and Places.
Birmingham and Midland Hardware District—W. Ryland.
Resources, Products, and Industrial History of Birmingham—Timmins.
Royal Ontario Nickel Commission Report.

[Newspaper Files—

Aris's Birmingham Gazette - 1862.
Birmingham Journal.
The Times - 1862.
The Birmingham Post - 1870.
The Birmingham Mail - 1878
The Birmingham Daily Post - 1905,
The Birmingham Daily Mail -1905,
The Birmingham Evening Dispatch - 1905.

Dictionary of National Biography.
History of Cheadle - Robert Plant.
History of England - G. M. Trevelyan,
Evans' Cottage Homes.
Patent Specifications.
J*ournal of the Institute of Metals.*

The assistance of Profesor RS, Hutton (Cambridge); A, Westwood Esq., Assay Master (Birmingham); H, Woodbine Esq,, A.LA., Chief Assistant, Reference Library, Birmingham; W. Martineau Esq.; Miss M. Twist of Cornish Brothers, Birmingham; Miss E. Hartley and other friends, in tracing references and records, is also gratefully acknowledged.

The firm known today and for the last sixty or sixty-five years as Henry Wiggin & Company Ltd. was founded in Birmingham by Brooke Evans and Charles Askin, in the year 1835. The original offices and works of the business were situated in George Street, Parade, at a period when the whole extent of the town was scarcely three miles. The outermost street-line on the north-west side was the joint thoroughfare of Monument Road, Icknield Street and Warstone Lane: along the main north road from Birmingham by Great Hampton Street and Hockley Hill, the town extended only as far as Hockley Brook, and St. George's Church was an outer landmark, Edgbaston was still a village, although fast becoming a residential suburb of Birmingham. Several of the outer thoroughfares of the town were blocked by turnpike gates and toll-bars. Even in those days, however, Birmingham was a town of some relative importance, since the population in 1831 is given as a little over 142,000.*

A general description of the lay-out of the town during this period is not without interest, although contemporary opinions differ appreciably as to its condition. A writer of 1819 states that "the entrances into several streets have been made considerably wider, and by that means rendered more commodious; some of the streets have been re-paved, and the water conveyed by culverts, instead of annoying the pedestrians as it used to do." Twenty-three years later, however, another writer states that "the streets are a scandal to the name, a nuisance in wet, and a greater nuisance in dry, weather; the footpaths in the centre of the town would disgrace a rural village; both footway and horseway in the remoter streets and the outskirts are but alternations of kennel and mire; the lighting is little better than darkness visible."

When Charles Askin first came to Birmingham the town was supplied with water through the medium of water-carts, although in 1831 a more efficient (but still inadequate) supply was organised by the newly-formed Waterworks Company. Reports of the period state that the sanitation was seriously deficient. The chief shopping centre was High Street, described as "a busy street, garnished with handsome shops." 'The upper end of New Street, however, still had the appearance of a semi-private thoroughfare. The local government of the town was nominally under the control of the old manorial officials, as in past centuries, but virtually the town was governed by the Commissioners of the Lamp Act and the Street Improvements Act. There were altogether eighty-nine such

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* The progress of Birmingham during the century intervening is indicated by the growth of the population to a figure of over 1,150,000.

Commissioners, together with H.M. Justices of the Peace for the County of Warwick, residing within 7 miles of the town of Birmingham. These Commissioners had full authority over the lighting, watching, draining and paving of the town, the regulation of street traffic, the control of watchmen, the making of by-laws, etc

The High Bailiff and the Court Leet still lingered on, although in reality they were without a vestige of power or authority. Their only duty was to proclaim, in primitive village fashion, much to the delight of young Birmingham and the amusement of the older members of the community, the Whitsuntide and Michaelmas half-yearly fairs, as had been done four or five hundred years before.

The *Birmingham Journal* of the day, referring to the Local Government, wrote - "We have our Court Leet and our Bailiffs, chosen by themselves; our Street Commissioners, chosen by themselves, our Town Hall Commissioners chosen by themselves, working in the dark, unseen by the public eye, irresponsive to the public voice; appointing their own officers, levying taxes at their pleasure, and distributing them without check or control, as their inclinations shall determine."*

INDUSTRIES OF BIRMINGHAM

'The Birmingham Directory of 1835 gives a list of 120 trades as regularly carried on in the town, and even in those days the metal industry was easily first in importance. Birmingham had iron foundries and manufactured iron and steel tools for agriculture, building and houschold equipment. The brass trade had become well-established and provided employment for craftsmen in many finished products—for example, chandeliers, gas fittings, lamps, vases, inkstands, tripods and metallic bedsteads. Medals were the fashion of the day and Birmingham supplied practically the entire demand,

Amongst other trades were those of gilt toy-makers, pewter craftsmen, gold and silversmiths, glass painters and stainers, and there were factories for the manufacture of buttons, pins, papier-mâché and japanned articles. Swords, guns and ammunition were also manufactured in the town and steam engines at the famous works of Matthew Boulton,

Many of these industries clustered around the district of which George Street, Parade, was the centre,

At that period, immediately prior to the inauguration of the first railway serving Birmingham, the stage coach was the only means of travel and communication. Several inns in New Street and High Street were coaching stations, and it is said that as many as twenty services ran daily, at almost any hour of the day or night. It is interesting to note that these were considered "admirable combinations of speed and punctuality, by which the traveller—if the season be not earlier or later than the term bounded by the equinoxes-may see the light of the same day in Birmingham and in London."*

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* R.K, Dent. The Making of Birmingham.

† By 1935 this number had increased ten times, i.e. to over 1,200.

In 1837 the first railway between Birmingham and Liverpool was opened, with a temporary station at Vauxhall, and in 1844 New Street station was built, this construction effecting the greatest change in the appearance of the town up to this time. The advance throughout England of what was known then as the "iron horse," was keenly opposed and the Birmingham local press was not behind the rest of the country in attacking "the folly and even wickedness of travelling at 12 miles per hour."†

Just before the founding of the firm of Evans & Askin the earliest type of street car was introduced into Birmingham, in the shape of a steam-coach which carried about 40 people and was used for short journeys in the immediate country districts.

Even in those days Birmingham had no fewer than four newspapers of her own. They were, however, costly and until 1836, 5d. was the minimum price of a newspaper worth today probably less than Id.

Compulsory education was not then known. It was only in 1833 that the State began to take any interest in the matter, but Birmingham appears to have been among the more advanced towns and within the City there were about 30 schools, including the famous King Edward School in New Street. Out of a population of nearly 150,000, however, only 15,000 children were receiving education. The schools were for the most part chatity-endowed or under the organisation and control of the churches. Yet in spite of its comparatively limited educational facilities, Birmingham had some claim to culture, and even in those early days there existed a Philosophical Society and a Mechanics' Institute. It is said of the latter that it was the first Mechanics' Institute ever projected in England and thus may be regarded as the parent of the polytechnic organisations. G.M. Trevelyan in his *History of England* writes that "It was from the Mechanics' Institutes that the adult education of the new age took a star."

INDUSTRIAL CONDITIONS

The transformation of Birmingham from a market town to an industrial centre had already been in progress many years: Burke's famous allusion to it in the House of Commons as the "Toyshop of Europe" will be readily recalled, There were still no

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* Drake. *Picture of Birmingham*.

† R.K. Dent. *The Making of Birmingham*.

Factory Acts, however, and Birmingham did not differ from other centres in her conditions, of labour. Boys and girls, from seven years of age, and women, were employed in the factories, and there was no maximum of working hours. It was not until 1847 that the Factories Act limited the work of juveniles and women to ten hours per day.

The following details indicate the general standard of wages paid in those days and give some idea of the general industrial conditions of the time. “They are taken from a paper read before the Statistical Section of the British Association at its meeting in Birmingham {in 1839 and show the average wage rates of 791 workers employed in 110 different branches of trade:-

Age	Males	Females
7-13 years	3/1 per week.	2/4 per week
14-20,	5/9 “ “	5/2 “ “
‘Above 20 years	24/3 “ “	8/- “ “

Women of twenty years and over were evidently regarded as of little more value than girls in their teens.

During what were known as the “hungry forties” even these low rates of wages were appreciably reduced, one record indicating that in some branches of the metal trades wages were reduced to one-third of the standard rates.

These same standard rates seem to have existed with very little improvement right up to the eighties, although in some factories - certainly in that of the Wiggin Company— the workers were enabled to earn higher rates by means of bonuses and special allowances.

An interesting sidelight on conditions of employment in the early days of the Company is afforded by an Agreement relating to the engagement of a clerk by Evans and Askin, which is still in existence. It is worded as follows:—

> “It is agreed this twenty-first day of July, 1846, between William Bromige ofthe one part and Brooke Evans and Charles Askin of the other part as follows. The said Wiliam Bromige agrees to serve the said Brooke Evans and Charles Askin at a Clerk etc, for twelve months from this day and to work for them alone and faithfully perform their orders Sundays and Bank Holidays excepted at the wages of eighteen shillings which the sad Brooke Evans and Charles Askin agree to pay every Ssturday such service being performed”

Signed by EVANS and ASKIN
‘Wm, BROMIGE

Witness
HENRY WIGGIN

It may be added that this William Bromige later became one of the most trusted senior officials of the firm. He took a considerable interest in the welfare of the workmen, organising such activities as a night school (to teach reading and writing), a sick club (to which the firm contributed), and other social services which in those days were by no means usual in industrial works.

1788-1847

CHARLES ASKIN

THE FIRM OF EVANS AND ASKIN

It was into this town of Birmingham, eight years before the founding of the firm, that Charles Askin came to practise as a veterinary surgeon. He was born in Cheadle in 1788. His father was a linen draper and Charles, although he disliked it exceedingly, was brought up to the same business. From boyhood he was interested in chemical and scientific pursuits, although probably with but slight encouragement from his father. Explosions from his little laboratory on more than one occasion nearly frightened his parents out of their senses, and one of these was really so serious that its report caused great consternation in the town. His friends called him “the schemer.”

Immediately on the death of his father, Charles promptly sold the drapery business and went to London to study and qualify as a veterinary surgeon; while in the metropolis he also attended such scientific classes as were within his reach. On the completion of his studies he established a practice in Birmingham (Cherry Street), where he was tolerably successful, but apparently the work did not satisfy his scientific instincts, for he spent all his spare time in experimental work in chemistry. It is not easy to determine the motive underlying the choice of veterinary work by a man in his thirties, whose dominating interest was experimental science: it may be that, added to the scientific urge, there was a love of animals. It is likely, however, that his interest in metallurgical chemistry, a any rate, was fostered by the industrial atmosphere of the town in which he had come to live. A circle of friends appears to have been formed by these scientific interests, including Mr. Evans, a woollen draper, whose garden abutted on the bottom of Askin’s premises in Cherry Street. Mr. Evans's sons were subsequently associated with Askin in the development of the metallurgical industry which made his name.

It was almost inevitable that sooner or later Askin would abandon the practice of veterinary surgery in favour of metallurgy, and the opportunity came when, in 1832, one of his friends was appointed by the Mexican Mining Company as Manager of some extensive works abroad. The young man’s parents and friends strongly objected to his accepting the position and he offered the opportunity to Charles Askin, who appears to have promptly accepted it, at the same salary. His first stipulation to the Company was that he should visit German mining enterprises in order to perfect himself in the details of refining metals. Almost immediately he sold his veterinary practice and travelled to the Continent, where he stayed for six months, visiting all the principal mining and refining firms there.

In the meantime, the three sons of Mr. Evans the woollen draper, Brooke, Alfred and Douglas, had acquired an iron works in Poland, and during his stay on the Continent, Askin visited these works. It was during this visit that his interest was first aroused in nickel and its alloys. It is said that he saw in a shop some spoons and forks of a new metal but recently introduced from Germany, called “Argentan,” some of which he bought.* One of these, when accidentally dropped, broke in two and showed a dull grey fracture which to Askin’s imagination revealed imperfections and impurities. It appears to be this incident that first aroused his interest in alloy metallurgy.

On returning to England, Askin was preparing to go to Mexico, when the Company desired to modify the terms they had made with him. Charles Askin was a very impulsive man and instantly refused to go on the modified terms, His Continental expenses had, however, been very heavy and the proceeds of his Cherry Street practice were almost exhausted, so that his prospects must have been, to say the least of it, depressing. The next six months he spent in Leamington with his brother, who was Manager of the Gas Works there, and it was during these months, working in a laboratory placed at his disposal by his brother, that Askin succeeded in producing a small ingot of the alloy ““Argentan” or “German Silver.” According to report this ingot measured 6 inches in length and half an inch in section. He brought it to his old friend, Mr. Henry Merry of Cherry Street, who took an immediate interest in the discovery. The question arose ““Will it roll?” and the two friends immediately took the “precious” ingot to Phipson’s rolling mill in Fazeley Street to have it tried. Charles Askin, in after years, used to describe the agitation he felt as the workmen placed his little ingot within the jaws of the ponderous mill. His pulse throbbed and his “heart came into his throat” as the dull white bar disappeared. He then describes how he and his friends went to the back of the mill and saw there a bright and glittering ribbon, many feet in length, lying in graceful curves upon the floor. Merry gave his companion a hearty smack upon the back, saying jubilantly, “Askin, your fortune’s made!”

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* In view of the controversies which have arisen from time to time regarding the beginning of the nickel silver industry in Europe, it may be of intrest to quote the following note by Dr. B. Neumann, (Zeitsch. für angewandte Chemie, 1903, Heft 16, pp. 225-232)

“Undoubtedly the beginning of the nickel silver industry in the utilisation of the hitherto “unused nickel, dates from the year 1823-1824, Previous to this and before the identity of the metal “nickel was known, alloys called “Packfong” or “White Copper" came to Europe. A copper-nickel “alloy had even been used in pre-Christian days for coinage. Also in the middle of the 18th century “in various places in Thuringen, copper-nickel alloys were worked, although their composition was “unknown, The actual inducement for the preparation of nickel silver mixture is due to the analysis “of the Chinese white copper published by Fyfe in July, 1822, *Edinburgh Philosophical Journal* “Fyfe deseribes the Chinese articles from which he obtained a small piece for analysis. The analysis “gave - 13

40.4% Copper
25.4% Zinc
31.6% Nickel
2.6% Iron

“As a matter of fact, 40-45 years previously Engstrom and Rinman had analysed this white copper “and given satisfactory compositions. Engstrom (*Abh. Akad. Wiss,* Stockholm, 1776, Vol 37, p35) “describes the form in which the metal is sold in the raw state in China, Directly in consequence of “Fyfe’s publication, the Prussian Society for Encouragement of Industry (Verein zür Beforderung ‘des Gewerbefleisses), an Association started in 1821, showed great interest in this alloy, and offered “a prize on the following

> “The Gold Medal or its equivalent and also 200 Thaler for the erection of a Factory in Prussia “in which a metal mixture to be discovered shall be worked, which shall be equal in colour to “12 alloy silver, and like this can be formed into spoons, candlesticks and other wrought “articles, which shall be insoluble in ordinary foods, and exert no harmful influence on health, “and which shall cost at most a sixth of the value of silver.”

Immediately afterwards (actually in 1833) a partnership was formed between Charles Askin and Henry and Theophilus Merry, under the style of Merry & Company, in order to undertake the manufacture of the new alloy German Silver. Premises were built at Sherborne Wharf, in Ladywood, and the nickel residues from the Potteries (which will be referred to later) formed their raw material. It is to the activities of this partnership that the Royal Ontario Nickel Commission refers in stating that their production was known as “Merry’s plate” and “Merry’s metal blanc.” The business was an immediate success, but for some unknown reason the partnership terms did not prove satisfactory,

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“This prize was offered several years consecutively, and last in 1826, but no trace can be found of a “record of its award having been made. At the November meeting of this Society, Frick described “several nickel silver alloys from which articles could be wrought, and reckoned the cost price as “4 Thaler a pound. Shortly before this, Ch. Kefferstein, before the meeting of the German Natural “Philosophers and Doctors at Halle (*Schweiggers Journ. der Chemie u Physik*, 1823, Vol. 39, p. 17), “describes how for a long time past a white copper had been made at Suhl and other “places, from which mountings of weapons and other decorations were made. Previously the “composition of this alloy was unknown but now they found it to consist of copper-nickel. Frick “then continued his work and in December, 1823, published a further paper in which he indicates the “proportion of nickel necessary to whiten the copper and the addition of zinc desirable to give a good “alloy. In April, 1824, several samples of articles of Argentan were shown by Dr. Geitner of “‘Schneeberg, from the firm of J. Chr. Hockheimer, in Leipzig. In August or September, 1824, it is “reported that Dr. Geitner of the Chemical Factory of Schneeberg, a cobalt-blue factory, makes an “alloy called ‘Argentan’ and sells it in the raw state at three Thaler a pound. From this alloy J. C. “Hockheimer in Leipzig makes numerous articles such as stirrups, chains, rosettes, etc. In 1829, “Geitner started a second nickel silver factory at Auerhammer. Saxon Government red tape “prevented Geitner fully exploiting his industry, for on 14th June, 1826, it was prohibited to make “tea-pots, coffee-pots, and milk jugs unless the inside was gilt, and an absolute prohibition was “imposed on its employment for spoons used for eating. Coffee spoons, sugar tongs, tea strainers, “etc., might, however, be made. The Prussian Goverment was less restrictive and the firm Gebrüder “Henniger & Company commenced by purchasing Argentan from Geitner in December, 1824, and “thereafter quickly developed their own nickel silver manufacture. In 1825, a nickel silver factory “was founded at Vienna by von Gersdorff, who, in 1826, sold nickel silver at 2 florins 24 kroner the “Vienna pound and fairly pure nickel at 8 florins the pound.”

and at the end of thirteen months Charles Askin retired from the firm, taking £1,500 as his share of the profits. It was then that the firm of Evans & Askin was projected. The Evans family appear to have been amongst Askin's oldest friends and seeing that his discovery seemed to have the elements of success, they came forward with ample financial resources and, fortunately, keen business acumen. Brooke Evans is the brother who is usually spoken of as forming the partnership, but various authorities indicate that to some extent, at any rate, the two other brothers, Alfred and Douglas, had also a financial interest. (Since, however, the main portion of the capital was in any case supplied by the Evanses it would appear that Brooke Evans really represented the Evans family.) Whatever internal arrangements were made, Brooke Evans was certainly the active commercial head of the firm, while Askin took charge of the technical side.

Brooke Evans was born in Bull Street on the 8th June, 1797. It is interesting to note that he received his earlier education at a school founded by Thomas Wright Hill, the father of Sir Rowland Hill, and it is exceedingly probable that Brooke Evans was a contemporary scholar of Rowland Hill. He left school at fifteen and was apprenticed to a gun maker, afterwards going to America to enter into partnership with a gun maker in New York. This enterprise was only partially successful, and he returned to England probably about 1826 or earlier. America, however, still attracted him and he returned to Central Guatemala to prospect as an indigo planter. In this enterprise he was financially successful but had to return after a short stay of twelve months on account of the unhealthy climate.

Young Evans's capacity and grit are well illustrated by an incident recorded of his return voyage. In the Gulf of Mexico, yellow fever broke out amongst the crew, and several, including the Captain, went down with it. Evans took command and navigated the ship successfully to the British Isles. On his return to England he purchased a small business in the glass and lead trade at Stratford-on-Avon, where he lived for six years and was again successful, accumulating a small fortune of between five and six thousand pounds.

Records of the life of Brooke Evans are unfortunately meagre, but sufficient is known to indicate that he staunchly supported and encouraged Askin in his technical activities and that, in addition, he brought to the firm of Evans & Askin considerable business experience and foresight.

The new firm established itself in premises in George Street, Parade, Birmingham, and was known as "Evans & Askin—Nickel Refiners and German Silver Manufacturers." The only source of its raw material at that time was the crude nickel speiss from the Potteries, with which Askin had originally experimented. These supplies, however, soon

1797-1862

BROOKE EVANS

became exhausted and the business quickly found itself in difficulties owing to the uncertainty of the situation.

At that time no other source of nickel appeared to be available, yet the demand for the new alloys increased considerably. Brooke Evans went to the Continent to investigate the possibilities of obtaining supplies there and ultimately, at the University of Freiburg, he met a Scottish metallurgical student named Gordon, who introduced him to a young Hungarian fellow student called Mordach. It was at Mordach's suggestion that Evans posted off "in the dead of winter' to the village of Dabshau, in the Carpathian Mountains, where he found a nickel-cobalt-arsenide ore which was then entirely unfamiliar to him. He bought as much of it as he could afford at the time and returned to England. The finding of this new source of supply, however, was by no means a solution of the new firm's difficulties, for Askin's process of refining was absolutely useless when applied to the new ore, and although the partners found themselves possessors of material containing at least two very valuable and important elements, they had no means of separating them. The seriousness of the situation was intensified by the fact that, although the ore was known to contain cobalt, and might therefore be presumed to be useful for pottery, the presence of an equal proportion of nickel made it completely unsuitable for such purposes. The ore contained, in addition to nickel and cobalt, copper, bismuth, iron, arsenic and other impurities, and inevitably failed to give the cobalt blue required by the colour makers in the Potteries. The whole solution of the problem hung upon the discovery of some method of separating nickel and cobalt, and the chemical text-books of that age had apparently no suggestions to make.

It appears that both Askin himself and his friends in the Potteries had attempted to refine the ores by the usual fire-refining methods, but with complete lack of success; Askin therefore endeavoured for a time to effect some degree of refining by wet methods. He succeeded reasonably well in making solutions of the ore, but it appeared to be an impossibility to secure separation in any appreciable degree of purity. Askin, however, happened to be in close touch with Mr. White Benson (father of the late Archbishop Benson), who at that time was the Managing Director of the British White Lead Company, Birmingham Heath, now known as Icknield Port Road. When discussing the problem one day, Benson made the suggestion that it might be possible to precipitate the cobalt from a solution of the two metals by means of bleaching powder, a double chloride and hydrochlorite of calcium. It was agreed that each of them should simultaneously carry out an experiment in his own laboratory. Benson, having an ample supply of bleaching powder, used sufficient to precipitate the whole of the metals in solution and naturally concluded that the process was useless, since the deposit was found to consist of the two oxides, nickel and cobalt, mixed together. Although Benson had apparently failed, his idea turned out to be both scientifically and practically sound, for it was based on fractional precipitation, and an accident in favour of Askin demonstrated this in a fashion which was at once startling and eminently satisfactory. Askin duly prepared for his series of experiments, but found to his annoyance and disappointment that he had only about half the bleaching powder it was proposed to use. In sheer desperation, he emptied the bottle into the solution, and, as he expected, got only a comparatively small precipitate. On examination, however, he found to his intense surprise and delight that this precipitate was pure sesquioxide of cobalt, absolutely free from nickel, and that the nickel was contained in the clear green solution above. It was a very simple second step to precipitate this nickel by ordinary lime, and the apparently insurmountable problem of the separation of nickel and cobalt had thus been completely solved. Subsequent history demonstrated the soundness of the procedure, since this principle has been adopted in all wet refining processes involving the separation of nickel and cobalt from arsenical ores. Unquestionably this discovery laid the foundation of the firm's subsequent success, for not only had it furnished Askin with a source of supply of nickel, but it effected an almost complete revolution in pottery ornamentation, by furnishing the Potteries with pure oxide of cobalt. Hitherto, the pottery industry had been compelled to use an impure cobalt obtained from the Saxony ores which produced "Zaffre" blue, the dirty blue well-known in the famous "willow pattern" pottery. Now the use of pure cobalt oxide furnished the possibility of producing the most exquisite blue tints from pale grey to deepest purple. From Birmingham the oxide was sent to all the principal works in the world in the pottery and glass trade. In the 'sixties the renowned works of Sévres obtained the blues for their exquisite colours from Birmingham. The English potteries of Wedgwood and Copeland were also supplied. The product of the Evans & Askin works was successful, not only technically but financially, since the makers obtained a price at that time of approximately £2. 2. 0. per pound.

The firm was now seriously established in business as nickel and cobalt refiners, producing not only nickel but cobalt and its compounds. The supply of raw material, however, still continued to give the partners considerable anxiety, and ultimately a mining engineer named Forbes[*] was sent out by them to the Continent to investigate the possibilities of obtaining further ore supplies. Among other ventures Forbes succeeded in securing a small mine in Bolivia[†] and this was worked for a time, without, however, very great success, for the cost of transport across the desert on the backs of mules was exceedingly high. A mine was also secured and worked at Gusdal in Norway, and later at Espedal, but these were very poor and again costly to work. Brooke Evans appears to have been by far the more active of the two partners in scouring the world for supplies and during his lifetime showed considerable enterprise in investigating mining possibilities.

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[*] David Forbes, the engineer referred to here, was for some time connected with the Espedal Copper Works, Norway, and had attained considerable repute as a mining metallurgist and chemist. An interesting contribution by him on the "Chemical Examination of Purple Copper Ores and Copper Pyrites" appeared in the *Edinburgh New Philosophical Journal* for April, 1851.

[†] See also p.33

In the meantime, about five years after the establishment of the firm, the market for "German Silver" alloys was rather suddenly and appreciably expanded as a result of Elkington's discovery of a commercial method of electro-silver plating. It soon became obvious that "German Silver" was particularly suitable as a basis metal for this purpose and the Elkington Company in Birmingham, and other firms starting in Sheffield about the same time, quickly created a considerably increased demand for the metal.

It was in the year 1842 that Henry Wiggin joined the firm. He had been born in Cheadle on February 14th, 1824, and in 1838, at the age of fourteen, had come to Birmingham, as apprentice to the firm of drapers, Whitlock & Fisher, in Bull Street. From the time of his arrival in Birmingham, the boy spent his Sundays at the home of Charles Askin, who was an intimate friend of Wiggin's father and, like him, a native of Cheadle. Askin, struck by the boy's business ability and his liking for scientific study, obtained the consent of Wiggin's father to the transfer of his son's indentures, and at the age of eighteen the young apprentice became a junior assistant to Askin. In this capacity he studied the scientific side of nickel and cobalt refining, as well as the commercial aspects of the business. He appears to have come under the influence also of Dr. Percy, then Professor of Chemistry at Queens College, and attended lectures at the old Philosophical Institution, with his friend, George Shaw, subsequently the well-known patent agent.

Between the years 1842 and 1848, the refining side of the firm's business was moved to premises on Birmingham Heath (now known as Wiggin Street), adjoining those of White Benson. It is interesting to note that these premises had previously been in the occupation of an Austrian named Brandeis, who had surreptitiously copied Evans's and Askin's manufacturing processes and started business on his own account. For some reason or other he was completely unsuccessful and was glad to dispose of both his premises and business to his competitors. The examination of the premises was entrusted to young Henry Wiggin, who found that the Austrian's failure was due to the inefficient way in which his ores had been smelted: it is reported that from Brandeis's discarded slag Wiggin discovered sufficient nickel and cobalt to recoup almost the entire purchase price of the new works.

In 1847 Charles Askin was about to retire when, at the request of his friend, Brooke Evans, he consented to pay a visit to the romantic mountain village of Gusdal in Norway.

He was accompanied by Forbes and they stayed at the house of the village pastor. One day (on the 25th August to be exact) Forbes playfully suggested that they should both stand back to back to see which was the taller. As they stood up to do so Askin collapsed and died. He was buried in the little village where he died, but his friends in this country directed that his body should be exhumed and sent home. It was brought to Christiania, but on arrival there the winter had so far advanced that navigation was closed by ice. The coffin was buried, a second time, in the cemetery of the city. The following spring it was again exhumed, but owing to the superstition of the sailors, who refused to sail in a vessel carrying a corpse, there were considerable obstacles. At length the difficulty was overcome by extra payment, but the vessel met with a fearful storm in the North Sea and had to be abandoned. It was, however, brought to Yarmouth as a derelict, and eventually the body found a resting place in the churchyard at Edgbaston, where it lies near to those of his friends and partners, Alfred and Brooke Evans.

In his Will, Charles Askin remembered Henry Wiggin, who was then (1848) taken into partnership by Brooke Evans. He was a young man of only twenty-four, but it is recorded that his "strict and energetic attention to duties and accurate scientific operations" commended him to this position,

Brooke Evans, upon whom now devolved the management of the business, continued to be the leading spirit of the firm until his death, which occurred on the 15th September, 1862. Obituary notices are unanimous in describing him as a man of outstanding personality and superior intellectual attainments. He was a brilliant conversationalist, with, naturally, a considerable fund of travelling experiences, from which he drew freely in social intercourse.

Meanwhile, his two brothers, Alfred and Douglas, continued business in Warsaw, where they built up a large Russian trade. It is said that they remained in Poland for many years and it was their custom to keep open house and to receive many interesting visitors, diplomats, soldiers and others travelling in Central Europe. One authority states that Brooke Evans also lived for a while in Warsaw, but of this there is no certainty; at any rate it could not have been for more than a short time, in view of his travels in America, to which reference has already been made.

Ultimately the Evans brothers, returning from Poland, appear to have settled down in Edgbaston, where they built a house known as "Mariemont," afterwards inhabited by Sir Oliver Lodge. Here also they kept open house and were in touch with many well-known people.

An interesting point is recorded of Alfred Evans, who ultimately survived both his brothers and sister. He had accumulated a considerable fortune, and had also been left sole legatee of his brothers' respective personal estates. He was anxious to spend his money to advantage, and consulted Mr. and Mrs. Wiggin, as they then were, with reference to its disposal. It is believed that Mrs. Wiggin suggested to him that he might do something to help gentlewomen who had fallen upon hard times and who were barely able to exist without assistance. The outcome of this suggestion was the Evans' Cottage Homes, which have been for many years a feature of Birmingham charities.

It is uncertain exactly when Henry Wiggin took over the business, but most authorities agree that it was after the death of Brooke Evans, probably about 1865, that the sole control of the business devolved upon Wiggin. Apparently Alfred and Douglas Evans were never more than sleeping partners. There is conclusive evidence, however, that the firm's name was not altered until after the death of Alfred Evans in the year 1870.

Between the years 1840 and 1870, the Evans-Askin-Wiggin combination held almost complete control of the nickel industry in this country, and although elements of competition entered in from time to time, the technical skill and experience of these workers put them well ahead of all competitors in the refining of both nickel and cobalt so far as this country was concerned. It must, however, be pointed out that up to the year 1870 the total Wiggin production of nickel did not in all probability amount to more than about 200 tons per annum.

On the Continent of Europe production must have been greater, since by 1862 nickel began to enter in considerable proportion into the coinage of countries such as Switzerland and Belgium. Some idea of the cobalt output may be obtained from statistics which show that in 1860 (a fairly representative year) cobalt ore to the amount of three hundred and forty-one tons, with a declared value of £13,895, was imported into England. Although no exact figures are available, it is probable that the cobalt content of this ore ranged, approximately, from 2 per cent. to 5 per cent.

TECHNICAL CHAPTER III

In this chapter it is proposed to describe in some detail the technical processes initiated by Askin and developed by Henry Wiggin and his staff. It has already been indicated that up to 1875 no large deposits of nickel and cobalt ores were known and supplies had to be obtained, in comparatively small quantities, from various mines in different parts of the world. Naturally, since the particular character of the ore changed almost constantly, the treatment had also to be varied, for broadly speaking, the ores then available can be divided into three classes, arsenides, sulphides and oxidised ores, of which the first named was the most generally obtainable and most widely used. The primary metallurgical operation in every case was the production of either an arsenide "speiss" or sulphide "matte." In the case of the oxidised ores, the speiss was produced by smelting with some arsenical material and coke dust. Further stages of treatment consisted in repeated calcining and smelting of the material, in order to increase the percentage of nickel and cobalt and to remove as large a proportion of the iron as possible. The technical principle of the treatment is based on the fact that sulphide or arsenide of iron smelted with nickel or cobalt oxide and silica produces arsenide or sulphide of nickel or cobalt, together with silicate of iron. The separation could, of course, never be exact, and slag in those days always carried an appreciable quantity of nickel and cobalt, especially when the percentage of iron in the original material was fairly low. (It is this fact that largely explains the comparative failure of competitors of the Wiggin business in those early days.)

The speiss, when sufficiently concentrated (containing not more than 10 per cent. of iron), was crushed and calcined repeatedly, until it was perfectly oxidised without necessitating the entire removal of the arsenic.

The foregoing were, of course, furnace operations and the next series of operations was carried out entirely by wet methods. The diagram or flow sheet in Fig. 1 gives a general idea of the wet processes which were slowly evolved, by means of repeated experimental work, often rather empirical in character.

As indicated in the flow sheet, the calcined material from the furnace process was dissolved in hydrochloric acid and the iron precipitated as ferric arsenate by the addition of milk of lime. This iron precipitate was removed by filtration and the copper was then precipitated by electrolysis or by sulphuretted hydrogen or both. In the later history of the Wiggin wet refinery both methods were adopted, in order to ensure the complete removal of copper.

The electrolytic process presented rather considerable difficulties in those early days. In the earliest experiments the anodes used were graphite or carbon, but these required a difference of potential of from three to four volts and the efficiency of the current was very low. Lead anodes were out of the question, but the difficulty was ultimately solved through the work of G. A. Boeddicker, who is referred to later. Boeddicker conceived the idea of making semi-metallic anodes of ferro-nickel, cupro-nickel or cupro-nickel-sulphide, which were made from odd lots of speiss and nickel matte. Such anodes enabled the difference of potential to be reduced to 0.5 volts, and, of course, appreciably increased the efficiency of the process. It will be clear that anodes of these components introduced nickel into the solution, but since the whole of the solution was subsequently treated for the recovery of nickel this was not important. The necessity for the supplementary use of the process of precipitation by sulphuretted hydrogen arose from the fact that it was quite impossible to remove the last trace of copper from such solutions by electrolysis.

The next process was the precipitation of cobalt, by the method previously developed as the result of experiments by Benson & Askin (see pp. 17-18). As already pointed out, the principle of this separation is the precipitation of a sesquioxide of cobalt by the addition of hypochlorite and chlorite of lime. This operation was unquestionably the outstanding feature of the process and necessitated the utmost care. Fortunately, the firm had, even in those days, workmen of the very highest standard, who by sheer experience were able to control the operation almost exactly as it could be controlled in the laboratory itself. The standard aimed at was that the sesquioxide of cobalt precipitated by the bleaching powder process should not in any circumstances contain more than 2 per cent. of nickel, the quality generally achieved being below 1 per cent. Filtrate from this black sesquioxide contained practically the whole of the nickel, and the liquid was almost entirely free from cobalt.

The next process was obviously a very simple one, at any rate in theory, since nickel could be precipitated as nickel hydrate by the addition of milk of lime, and as this was the cheapest method of precipitation it was almost invariably adopted, except where a particular salt of nickel was required. The resulting hydrate was filtered, pressed, dried and subsequently washed most thoroughly to remove the whole of the calcium chloride.

The whole process of precipitation of nickel, although essentially simple in the technical principles involved, presented certain rather serious practical difficulties, inasmuch as the precipitated nickel hydrate always contained a certain amount of calcium sulphate, which could not be removed by washing. The method usually adopted was to treat the dried oxide (or the hydrate which had been dried and converted into oxide), after the washing out of calcium chloride, with sodium carbonate, in order to convert the calcium sulphate into carbonate. The sodium sulphate could, of course, be easily removed by washing with water and the final process was the extraction of the calcium carbonate by means of dilute hydrochloric acid.

Even with the precautions outlined above, the nickel oxide was not always of the purity desired, owing to impurities in the lime used for precipitation, which always contained small proportions of silica and magnesia. If the latter was present it was precipitated with the nickel and was most difficult to extract either with acid or with repeated water washing. As a consequence of this and other factors, despite the utmost skill and care, such as were unquestionably expended in the Wiggin wet refinery at that time, the metallic nickel produced from the refined oxide was seldom higher than 97-98 per cent. purity. The main impurities were magnesia, silica and iron.

The conversion of the washed and dried nickel oxide into metal was carried out by mixing the finely ground material with flour and rolling it into a paste, the process being almost analogous to the process of making bread or pastry. The thickness of the paste varied according to whether the material was required for the cutting of rondelles or cubes: it was approximately two inches thick if required for rondelles and about one inch if required for cubes. (At that period at the Wiggin wet refinery both cubes and rondelles were cut by hand.) The next process was to dry these on iron plates at a temperature slightly above the evaporation point of water, and they were then charged, with about an equal quantity of finely powdered charcoal, into fireclay crucibles and heated in furnaces of approximately the same type and design as the old style crucible steel furnaces, at a temperature of about 960° to 980°C., for a period varying from fifteen to eighteen hours.

This latter process was subsequently improved upon by the adoption of fireclay gas retorts, which were built horizontally in series into tiers heated from below by means of ordinary coal-fired furnaces connected with a combustion chamber so arranged that the heating flues passed over and under each row of retorts. This method enabled the process to be cheapened considerably, not only by effecting economies in fuel consumption but by enabling a much larger proportion of cubes or rondelles to be simultaneously charged and reduced. Each of the retorts held a quantity of approximately ten to twelve times that held by the crucibles formerly used, but owing to these larger quantities the time required for heating was somewhat longer than in the former crucible method (generally twenty to twenty-four hours).

Although the principle of this process was simple, namely, the reduction of nickel oxide to nickel by means of carbon, the standard of technique required was high. It was necessary, for example, to be extremely careful to charge the oxide rondelles or cubes into the retorts in such a way that the mixed charcoal was in fairly intimate contact with each individual piece. The closest possible attention was also required in the firing, since it was essential to keep the temperature as even as possible throughout. Under-heating resulted in badly reduced and highly carbonised nickel and over-heating in oxidised material. The result aimed at was the production of a compact, fine-grained, metallic rondelle or cube, free from either graphite or nickel oxide, and it speaks well for the skill of the workmen of those days that the standard normally reached was high. Occasionally batches would come out assaying as high as 98.5 per cent. And 98.7 per cent. metal, and the average was not seriously below this standard. After withdrawal from the crucible or retort the heated nickel rondelles and cubes were allowed to cool under a covering of charcoal: the latter precaution was an important factor in preserving the colour and general appearance of the metal. They were then taken to a shaking barrel, where they were polished by shaking with round steel balls.

Very similar procedure was followed in producing metallic cobalt, of which, as will be understood, the Wiggin Company produced considerable quantities. The normal form of metallic cobalt was, however, cubes, and in the later period of the Wiggin wet refinery these cubes were prepared, after mixing with flour, by machinery which compressed and cut the cubes in one operation.

In addition to the production of metallic nickel and cobalt, an important item in the Wiggin activities of that period was the manufacture of cobalt oxide and salts. Three types of oxide were regularly manufactured, known in the works as “black,” “grey” and “special.” These corresponded, respectively, to the following regular formule:—

CoO
Co_20_3
Co_30_4

Of the salts manufactured, the most important were chloride, carbonate, sulphate and a cobalt blue, which was essentially a silicate. It may be mentioned, in passing, that in recent years cobalt acetate was added to the list and became one of the most important of the Wiggin cobalt products.

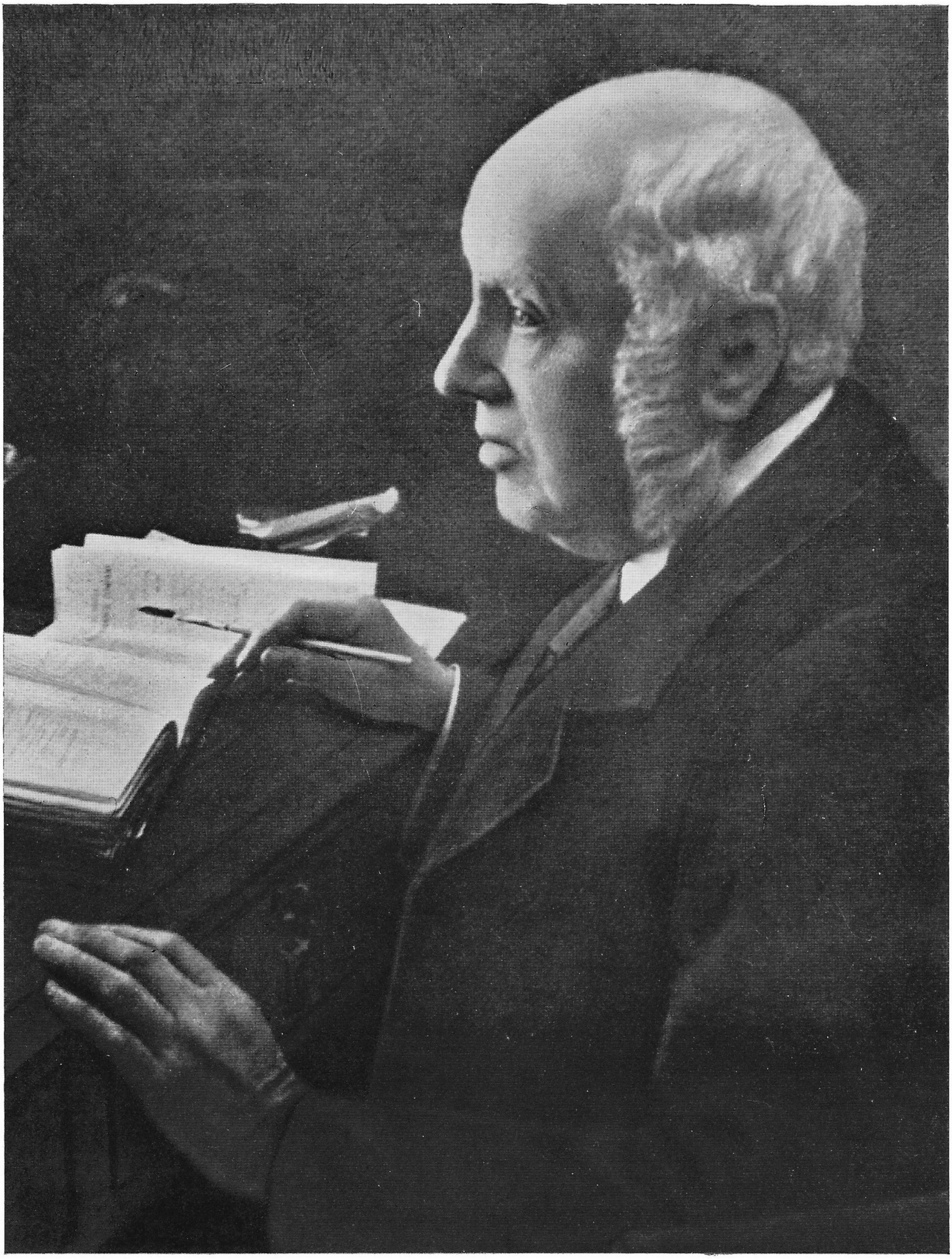
The manufacture of German Silver which had been the original raison d’étre of the business, was carried on until 1906 in the premises at George Street, Parade, where Evans & Askin commenced business.

For many years these German Silver ingots had to be sent to outside rolling mills; a daily service of delivery and collection of ingots was set up for this purpose. As indicated earlier in this history, the first ingots were rolled at Phipson’s mill, but there is some uncertainty as to the mills employed for the work in subsequent years. It is certain, however, that for a good number of years, probably from as early as 1851, the Bromford Mills, owned at that time by Messrs. Rollason & Sons, carried out by far the major part of the Wiggin rolling requirements. Ingots produced in those days rarely weighed more than eighteen to twenty pounds; occasionally a larger ingot was cast, but this was exceptional.

The compositions made varied from a low-grade German Silver, containing from five per cent. to seven per cent. nickel, to special qualities containing as much as thirty per cent. nickel. In addition to German Silver alloys, the firm was early called upon to produce anodes for nickel plating, and when rolled material was required these were cast from open hearth furnaces into square block moulds and hot-rolled at one of the steel rolling mills in the Oldbury area owned by William Hunt & Sons, and known as “The Brades.” Cast anodes were also produced and it is interesting to note that the majority of these were deliberately made somewhat impure by the addition of iron, in order to satisfy the demands of the electro-plater of those times for highly soluble anodes.

It has been already stated that after the death of Brooke Evans in 1865, Henry Wiggin took entire charge of the business. He was materially assisted by Alfred Smeaton Johnstone, a trusted employee who ultimately (in 1875)—sce p. 33—became a partner.

1824-1905



SIR HENRY WIGGIN, BART.

BIOGRAPHICAL DETAILS AND PUBLIC LIFE

THE business of the firm evidently did not entirely absorb Henry Wiggin's energy and vitality, and in the year 1861 he entered the Town Council of Birmingham as representative of the Ladywood Ward, in which the Works at Wiggin Street were situated. He remained a member of the Council until 1871. Wiggin immediately made his influence felt and was appointed to various committees, among which were the "Public Works," "Free Libraries," and "Health." He had been scarcely three years in the Council before he was appointed Mayor of the town. One year afterwards, in 1865, he was made an alderman; and in the same year he was appointed to the Commission of Peace for the Borough. At the time of his death he was senior magistrate.

Henry Wiggin's year of office as Mayor was one of exceptional activities, both for the Mayor and the town as a whole. One of his earlier duties as Mayor was to move a resolution expressing the horror of the inhabitants at the cowardly assassination of President Lincoln towards the close of the Civil War in America; the local press reported that the Birmingham resolution was the first message of condolence to reach Washington from Europe.

Another notable event of Wiggin's mayoralty was the first visit of the British Association to the town, and during this visit he had the privilege, as Mayor, of opening the new Free Library and Art Gallery in Ratcliff Place, "free to the people of Birmingham for ever."*

At a meeting of mechanical engineers held about the same time Wiggin initiated a movement for the erection of the statue to James Watt: the site chosen was Ratcliff Place.

References in the press of the period are unanimous in appreciation of his public services. He was described as a most popular mayor, not only hard-working but a supporter of all sound and progressive movements, even when unpopular, and as a princely dispenser of hospitality. At the close of his year of office, the following motion was adopted:-

> "That the Council desire to express to Henry Wiggin, Esq., late Mayor of this Borough, the high estimation in which they hold his public services during the past year, and at the same time to record their opinion that the duties, courtesies and hospitalities of the Mayoralty, could not have been performed or exercised by any gentleman in a manner more generous or satisfactory."

In 1865 Wiggin was made a County Magistrate for Staffordshire, and in 1872 also for Worcestershire, and in 1881 was Deputy Lieutenant for the County of Staffordshire.

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* An illustrated account of this function appears in The Illustrated London News, September 16th, 1865.

His public interests, however, were by no means confined to municipal or magisterial duties. He was a member of the governing body of the General Hospital and gave the first £1,000 to the endowment fund of the Jaffray Suburban Hospital. He was also President of the Children's Hospital and a member of the Managing Committee of the Queen's Hospital. He further took an intense interest in the educational organisations of the day, and held amongst other offices those of President of the Blue Coat School, Governor of the University, and for over twenty years Governor of the King Edward Foundation. He was also one of the founders and early vice-presidents of the Midland Institute.

Among other social questions of the day he evinced a keen interest in Old Age Pensions. This interest ultimately found expression in 1899 in the building of six houses, in Margaret Road, Harborne, intended for deserving old people past work—preferably belonging to the district. The only stipulations for the recipients of this charity were that they must have been thrifty and deserving and possess an income of not less than five shillings per week. Wiggin provided an endowment for the tenants, the income of which would provide a further five shillings weekly, with a surplus to cover rates, taxes and incidentals.

Even in his business life Wiggin did not confine his interests to his own firm. He became a director of the Birmingham Water Works Company, the Staffordshire & Birmingham Gas Company (before these were acquired by the Corporation) and the South Staffordshire Water Works Company. He was actively concerned in the promotion of the Parliamentary Bill for the construction of the West Suburban Railway, which ran from Granville Street to King's Norton, and for several years before his death was an active member of the Board of Directors of the Midland Railway Company, now incorporated in the London, Midland and Scottish Railway system.

Early in 1880 he was, with very great difficulty, persuaded to enter Parliament, being invited by the Liberal Party to stand as a candidate for East Staffordshire. He was duly elected and for twelve years he retained a seat in the House of Commons, from 1880-1885 as Member for East Staffordshire, and, after the re-distribution of seats, for the Handsworth Division of East Staffordshire (1885-1892). As member for East Staffordshire he represented the largest single-member constituency in the County.

Politically Henry Wiggin was a thorough Liberal but never an extreme Radical: he was a great admirer of John Bright. Wiggin regularly attended in the House of Commons but rarely spoke, except on mercantile or agricultural subjects, with which he could deal with knowledge and authority. He was extremely popular in the House, and his bluff and breezy manner won him numerous friends: he was one of a choice few who used to meet in the room of the Serjeant-at-Arms, Captain Cossett, and smoke a cigar. Parliamentary life, however, was never very congenial to him. As he often said, he preferred the green fields to sitting until four or five in the morning, week after week, during the exciting time of the Irish Party's obstruction of Parliamentary business.

In 1885, when Gladstone introduced the Home Rule Bill, Wiggin declined to support it. He made no secret of his views and when Gladstone found both Bright and Chamberlain opposed he endeavoured to win Wiggin over, since he was in the closest possible association with Birmingham. A personal friend of both Gladstone and Wiggin invited the latter to dinner to meet the Leader of the Party together with John Morley. It is reported that Gladstone talked at great length. but failed to influence Wiggin in the least degree. He was one of the little band of Liberals who finally voted against the Government and helped to secure the defeat of the Bill. In the general Election of 1892 he retired from Parliament and in the same year was created a Baronet.

No account, however slender, of the life of Henry Wiggin can be adequate without reference to his greatest hobby, which was agriculture. As early as 1860 he became a practical farmer and bought Lea End Farm near Alvechurch. He was one of the promoters of the Midland Farmers' Club, afterwards amalgamated with the Warwickshire Chamber of Agriculture. He always attributed his wonderful health to his agricultural interests. He spent all his spare time at Alvechurch, and even when in Parliament seldom missed a week-end there. After dinner on Saturday night he would go to Birmingham by the midnight train, sleep at Harborne, and drive over on Sunday afternoon to Alvechurch. He also acquired a pretty estate in the Llyfnant Valley, Montgomeryshire, known as "Garth Gwynion," Machynlleth.

Henry Wiggin married, in 1851, Mary Elizabeth Malins, second daughter of David Malins of Edgbaston (whose uncle, Dr. Malins, was High Bailiff of Birmingham before the incorporation of the town). On June 11th, 1901, Sir Henry and Lady Wiggin celebrated their golden wedding. Four years later, on November 12th, 1905, he died suddenly of heart failure, at the age of 81 years.

The following tribute by the late Mr. Joseph Chamberlain, at a meeting of the Committee of the Liberal Unionist Association after Sir Henry Wiggin's death, is of considerable interest:—

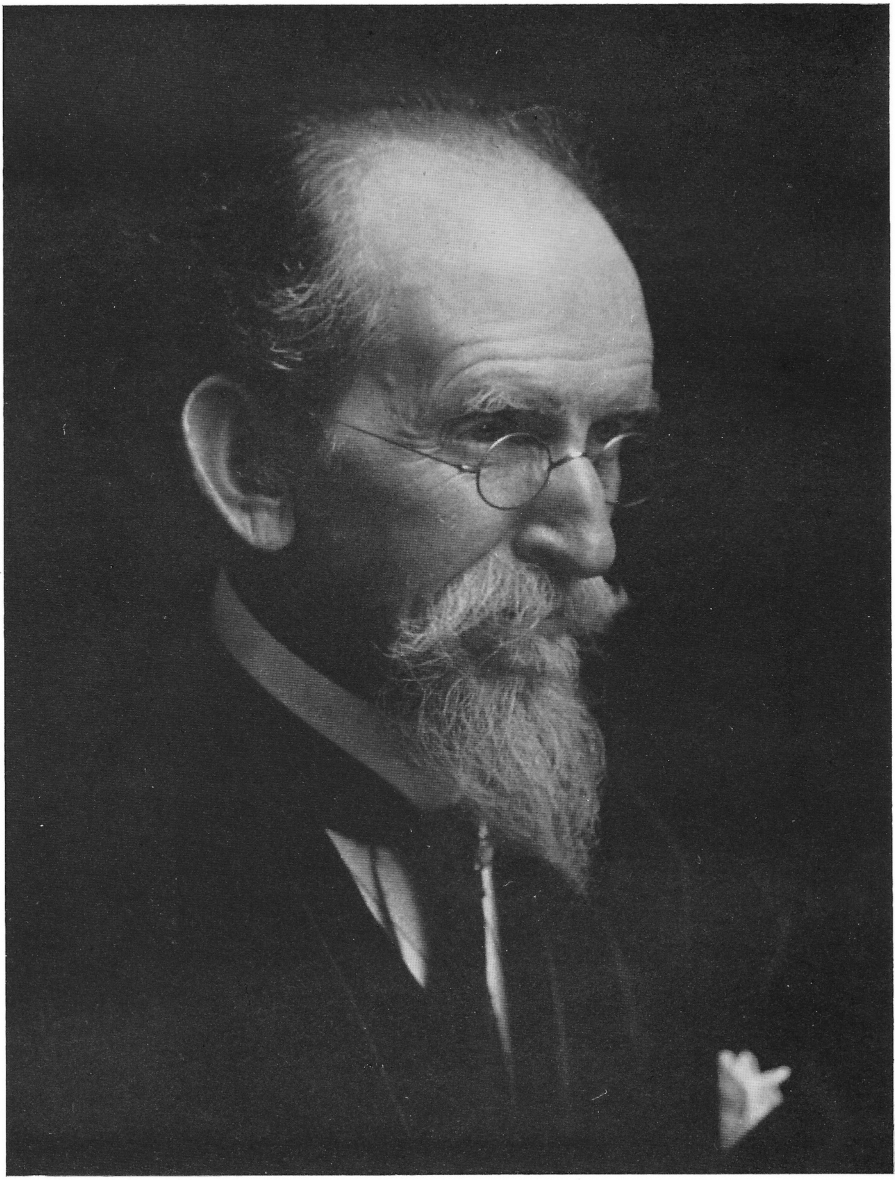
> Chamberlain proposed "That this Committee expresses its deep regret at the death of Sir Henry Wiggin, Bart., who throughout a long and active life set so high an example of public spirit, and whose unfailing kindness and courtesy endeared him to all with whom he was associated in different work, and this Committee offers to Lady Wiggin and family their assurance of their deepest sympathy."

In newspaper tributes it was said that Sir Henry Wiggin had really been a part of the history of Birmingham for at least half-a-century. There was nothing in the City of

Birmingham, and not a great deal in the immediate district around, in which he did not take some part or interest. In civic and municipal life, as representative of the district in Parliament, and- by his connection with all their education and charitable institutions, he was absolutely part of the City's public life. It was once said of him that he was "a man without fear or reproach, who for business ability, enterprise and energy, as well as for gentlemanly courtesy and public usefulness and true generosity of character, was second to none in the city or neighbourhood, a man whose exemplary career could be held up as a healthy stimulus and incentive to all the younger men of the succeeding generation, showing what diligence and courage could achieve."

Older employees of the firm, still surviving, speak of Sir Henry Wiggin in terms of deep affection. He knew most of his workpeople by their christian names and often recognised good work "on the spot" by gifts in money or kind. An indication of his great love of farming is furnished by an incident well remembered by one of the oldest surviving pensioners of the Company. During a spell of exceptionally fine weather the old gentleman came down to the works and ordered all the workmen off to his farm, saying that "the good harvesting of crops is more important even than refining nickel."

1835-1917



ALFRED SMEATON JOHNSTONE

Tue business was converted into a limited liability Company in 1892, the directors being all members of the Wiggin family with the exception of Johnstone, who, as mentioned in Chapter III, had been a partner since 1875.

It is unfortunate that Alfred Johnstone has left little or no record of his work, since unquestionably he exercised a considerable influence in the technical development and extension of the business. From such records as have been traced, Johnstone appears to have carried out a very large number of experiments in the manufacture of the German Silver series of alloys, studying particularly the effect of carbon and oxides.

Among other metallurgical investigations in connection with the manufacture of nickel alloys, Johnstone studied the effect of additions of manganese to nickel and cobalt, and in 1880, in conjunction with his co-directors, he took out a patent entitled "An improvement or improvements in treating nickel and cobalt," in which he describes the influence of manganese in rendering nickel and cobalt malleable and ductile.

A study of the few records which still exist indicates that the subject of malleableising nickel and cobalt by means of manganese, and the influence of this element also on both copper-nickel alloys and the German Silver series, was the subject of considerable experimental investigation at the Wiggin Works, and the work of Johnstone was followed up intensively by his colleague, G. A. Boeddicker, to whom further reference will be made later. One of the few published references to this work is found in Wagners Jahresbericht, 1881, vol. 27, p. 69, in which Boeddicker gives figures of one-and-a-half per cent. to three per cent. manganese as being the useful limits. Inter alia, the statement is there made that an addition of five per cent. manganese hardens nickel appreciably.

Johnstone also made an extensive study of the principles and practice of refining nickel ores, and effected many improvements, particularly in details of furnace construction and technique.

It is of interest to observe that Johnstone married a Miss Emma Inwards, daughter of Richard Inwards, a traveller of some note, who remarks in one of his publications, ""The Temple of the Andes" (privately published), that "In 1866 I was sent to Bolivia by that fine old firm of merchants, Messrs. Evans & Askin of Birmingham, who had cobalt mines on the steep side of Mount Sorata, almost at the limit of perpetual snow, in the very heart of the Aywara Indian Country."

In an obituary notice in the *Birmingham Post* of September 28th, 1917, the day following Johnstone's death, he is referred to as being "distinguished in literature, science and art-one of the most versatile men of the City.” His interest extended much beyond the sciences of metallurgy and mineralogy, in which he particularly specialised, for throughout his life he was something of both poet and painter. For many years he was a regular exhibitor of oils and water-colours at the Royal Society of Arts, and was equally successful in landscape and figures. He published a number of volumes of poetry and contributed largely to magazines and newspapers of the day. He was also a great lover of the theatre, and during October and November 1907 he contributed to the *Birmingham Gazette and Express*, under the general heading of “I Remember,” a series of articles embodying memories of old theatrical figures.

Johnstone remained a director of the Company until his death, which occurred at Hillside, Rednal, on September 27th, 1917, at the age of eighty-two.

After the entry of Henry Wiggin into public life, an appreciably increased responsibility rested upon Johnstone, who appears in the course of time to have felt acutely the need for further technical skill in the business. Enquiries were instituted both in this country and the Continent for a competent chemist to take charge of laboratory work. Some years elapsed before a suitable candidate could be found, but finally in 1877 Gustav Adolph Boeddicker, then chemist at the works of Basse & Selve, Altena, Westphalia, was offered the post of chemist to Henry Wiggin & Company, which he accepted. Boeddicker was only twenty-seven years of age when he came to England, but having already acquired considerable knowledge of the principles and technique of nickel refining, he quickly made his influence felt in the Birmingham works. It is due to Boeddicker that a number of refinements in the detail of the original processes were successfully adopted, with advantageous results both in cost of production and quality of product.

Boeddicker’s ability and energy were recognised quickly by both Johnstone and the Wiggin family, with the result that after a few years he was appointed Manager of the Wiggin Street works, and undertook the entire technical responsibility for both the refining side and the manufacture of alloys.

The following details of Boeddicker’s career will be of interest. He was born in 1850 in Iserlohn, Westphalia, and received his training in chemistry and metallurgy at the institution then known as the Berlin Technical College (later as the Charlottenburg High School), and at the Royal School of Mines, Berlin. After his student days he acted for a while as demonstrator and assistant to Dr. Finkener in Berlin, and subsequently, as previously stated, was appointed chemist at the nickel works of Basse & Selve at Altena, Westphalia. At his retirement in 1921, Boeddicker had been continuously in the service of the Wiggin firm for forty-four years. His metallurgical career was therefore inseparably bound up with the development of the Wiggin business. Although Boeddicker took

1850 - 1923

GUSTAV ADOLPH BOEDDICKER

considerable interest in the problems of alloy metallurgy, particularly in connection with the nickel-copper and nickel-copper-zinc alloys, there is no doubt that his earlier training profoundly influenced his metallurgical bent throughout the whole of his career, and it was in the art of refining nickel that he excelled. In his later years he was widely recognised as one of the leading authorities on this subject, and his advice and suggestions were always received with the greatest respect.

In 1908, when the Institute of Metals was formed, Boeddicker and one of his colleagues on the Wiggin Board of Directors at the time, Sir Henry H. Wiggin (second baronet), became members of the Council, and Boeddicker, particularly, played a very active part in the development of that Institute in its early years. His was, indeed, an outstanding influence in proposals for forming local sections of that Institute, and he was the first Chairman of the first local section, which was established in Birmingham in the year 1911.

Although a German by birth and a sincere lover of his native country, Boeddicker in his later years undoubtedly regarded England as his home; he won in this country the respect and esteem of a large circle of friends outside the firm with which he was so long connected, and had much to do with the awakening of interest in the scientific side of metallurgy which characterised Birmingham industries in the early part of the twentieth century.

Unfortunately, Boeddicker left little record of his metallurgical investigations, although from time to time he contributed to discussions at the meetings of the Institute of Metals.*

One subject on which his investigations were of considerable value was on the influence of carbon on cupro-nickel alloys, particularly the 80/20 per cent. and 75/25 per cent. compositions. †

Boeddicker continued until his death to be more or less actively interested in the business, although he officially retired from his post in 1921. The strain of the War, which in his case had a serious influence both mentally and physically, undermined his health, and during his latter years he was compelled to limit his activities. He died in 1923.

About the year 1888 the Wiggin Company bought the red lead manufacturing business carried on by Thomas Adkins at a small works in Smethwick near the end of the Lodge Road tram terminus, thereby acquiring considerably extended space. The manufacture of red lead was carried on as before, and in view of the urgent need for expansion in furnace operations on the Wiggin Street site, a section of the newly acquired property was used for the erection of cupola and reverbatory furnaces for the smelling of nickel and cobalt ores, The lay-out of these buildings was entrusted to Johnstone, and a separation was effected between furnacing processes and wet refining processes, the former being carried on entirely at Smethwick and the latter at Wiggin Street. Some few years after the acquirement of the Smethwick works an urgent demand was experienced in this country, from users of cobalt salts for enamelling and colouring purposes, for supplies of tin oxide, which up to that time was entirely imported from Germany. The subject was considered by the Wiggin partners, and as a result, in 1896, a small department was established on the Smethwick site for the manufacture of this product. The plant installed was imported from Germany and in the earlier years was operated entirely by German workmen.

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* e.g. *Jnl. Inst. Metals* 1909 (1), 295; 1909 (2), 211; 1910 (1), 207; 1910 (2), 257, 267; 1911 (2), 125; 1913 (1), 56, 113; 1914 (1), 142, 227, 234.

† See *Jnl. Inst. Metals* 1909 (2), 211.

The manufacture of tin oxide was carried on by the Wiggin Company only spasmodically, since both the demand and the prices were very erratic. It was worked with a reasonable measure of success until 1931, when it was finally closed down.

So far as nickel is concerned, however, the chief event of the period 1890-1900 was the invention of the Mond process of nickel refining, which naturally claimed considerable attention by the Wiggin directors and officials.

At a very early stage in the development of the Mond Process, discussions took place between Dr. Ludwig Mond and the Wiggin family. The only practical outcome of this was that an arrangement was arrived at whereby part of the land at Smethwick, together with certain buildings, were lent to Dr. Ludwig Mond and his colleague, Dr. Langer, for experimental work. The result of this was that actually the first carbonyl refined nickel produced on an industrial scale came from a model plant erected at Smethwick.

Many incidents are still recalled by the older workmen of the difficulties of the Mond process in those early days. These were rendered much more complicated by the various classes of ores available, which included materials so widely differing as the arsenical ores of New Caledonia and the sulphide ores of the Sudbury area of Canada. In view of the fact that the latter ores were then being developed on a large scale, the Mond Company naturally desired to use them. Difficulties arose, however, in the treatment of the nickel-copper matte, for it was found that only half the nickel could be extracted by the carbonyl method, since after that stage the action of carbon monoxide ceased. Boeddicker has left on record the statement that the solution of this problem was the subject of much discussion between Dr. Langer and himself, and that he (Boeddicker) suggested that the copper in the matte might first be leached out by sulphuric acid. Boeddicker states that he found that half the copper could be extracted from calcined copper-nickel matte by treating it with sulphuric acid and that very little nickel passed into the solution. Dr. Langer adopted the suggestion and this process has ever since been an essential feature in the carbonyl refining method for dealing with this class of material.

The year 1905 was one of considerable importance to the development of Henry Wiggin and Company, particularly in the production of alloys, since in that year the directors decided that the time had arrived when the Company should roll its own material and bring to an end the long-standing arrangements with outside rolling mills. Negotiations were entered into with Messrs. Rollason, at whose mill in Bromford most of the Wiggin rolling had been carried out and with whom the friendliest relationships existed. Ultimately, an agreement was concluded under which the Wiggin Company purchased the Bromford mills, and Mr. James Rollason at the same time became a member of the Wiggin Board. The individual mills were removed from Bromford to spare land at Wiggin Street situated at the corner of Wiggin Street itself and Icknield Port Road. In addition to the machinery, a number of the Bromford employees were taken over, including the mill foreman, Lavelle, who for ten years previously had been responsible for the rolling of Wiggin's ingots. The plant brought up from Bromford was designed entirely for cold-rolling, but shortly afterwards the directors decided to put down a hot-rolling mill, and the hot-rolling of nickel slabs at the Brades Mill, referred to in a previous chapter, was now also included in the Wiggin "mill production."

Very soon after the installation of the mill at Wiggin Street the firm took up seriously the manufacture of electrical resistance alloys, and in 1906 the production of the alloy known in Germany as "Constantan," approximately 40/43 per cent. nickel, 60/57 per cent. copper, was commenced. This alloy was known in the works at that time as "D" metal, but on the Ist January, 1910, the Company purchased from Mr. Lionel Robinson of London the trade name of "Ferry," which he had registered on the 22nd November, 1907. Robinson undertook the selling of this alloy and it was followed very shortly afterwards by the introduction of one of the nickel-chromium-iron series (containing 60/65 per cent. nickel, 12 per cent. chromium, remainder iron). This alloy was introduced (under the trade name of "'Chronic") for electrical heating purposes. Owing to the inadequacy of the casting equipment of the Wiggin Company at that time, however, "Chronic" was cast and rolled in Sheffield and brought to Birmingham for drawing into wire.

The period 1905-1912 was thus one of appreciable importance in the subsequent development of the firm's business and witnessed the foundation of its reputation as one of the leading manufacturers of electrical resistance alloys in the country.

The extension of the manufacture of alloys into this field necessitated the putting down of plant for wire drawing and tape rolling, and about the time of the outbreak of war, a new mill was built on the Wiggin Street site, especially for this class of work. The department was equipped with modern machinery and in addition to wire mills several draw-benches were put down for the production of profiles and sections.

It will be of interest at this point to refer to the close friendship which then existed between the well-known firm of Basse & Selve, Altena, Westphalia, and the Wiggin Company. The two companies had been for some time leaders, in their respective markets, in the production of cobalt and cobalt salts, as well as refined nickel: for the production of the latter metal both companies had analogous processes. In 1912 negotiations were opened up between Henry Wiggin & Company and Basse & Selve, for the introduction of what were then known as compound metals, i.e., nickel, cupro-nickel and brass rolled on steel. These products had in the meantime attained considerable popularity in Europe, particularly the combinations of nickel on steel and cupro-nickel on steel. The latter product had been adopted by the German Government for bullet envelopes and small arms ammunition, in place of the ordinary 80/20 cupro-nickel previously used. The following notes regarding these negotiations are inserted as a matter of technical interest:—

On November 29th, 1913, instructions for the carrying out of this process, together with a drawing, showing the method of preparing ingots and details of rolling technique, were forwarded to Birmingham from Germany, and a few weeks later, in December, 1913, specimens of rolled cupro-nickel on steel (in this case the 85/15 cupro-nickel alloy was used) were dispatched to England. These samples consisted of pieces in various stages of manufacture:—

(a) A steel block with cupro-nickel sheet on each side together with the outer packing ready for hot rolling.

(b) A blank hot rolled to 3 mm. thick and pickled.
(c) Strip cold rolled measuring 750 mm. in length x 160 mm. in width x 1 mm. thick.
(d) Finished strip 900 mm. x 155mm. x 0-86 mm.

Specimens were also forwarded of strip sheared to the standard sizes used in ammunition, namely 765 mm. X 27.94 x 0.86 mm. Samples of the finished product were submitted by Wiggin to the Authorities at Woolwich Arsenal for experimental work. Before, however, final negotiations were carried through, war broke out and the matter remained in abeyance until about 1917 when suitable equipment was put down at the Wiggin works for the production of this material on a commercial scale.

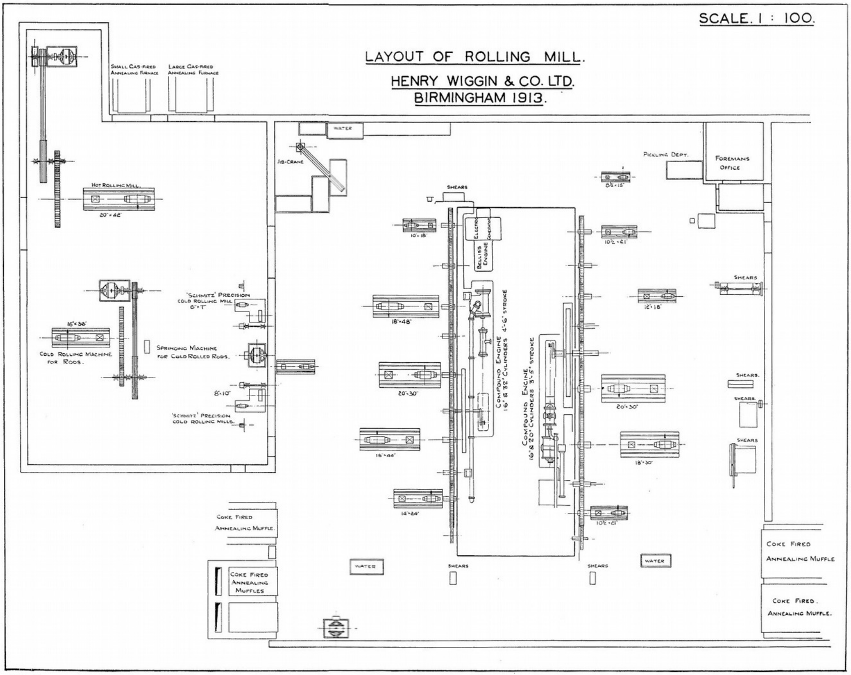

SCALE. 1 : 100.
LAYOUT OF ROLLING MILL.
HENRY WIGGIN & CO. LTD.
BIRMINGHAM 1913.
Small Gas-fired Annealing Furnace
Large Gas-fired Annealing Furnace
Water
Jib-Crane
Hot Rolling Mill.
20" × 42"
'Schmitz' Precision Cold Rolling Mill 6" × 7"
16" × 36"
Cold Rolling Machine for Rods.
Springing Machine for Cold Rolled Rods.
8" × 10"
'Schmitz' Precision Cold Rolling Mills.
Shears
10" × 18"
18" × 48"
20" × 30"
16" × 44"
14" × 24"
Electro Generator
Belliss Engine
Compound Engine 16" & 32" Cylinders 4'-6" Stroke
Compound Engine 16" & 20" Cylinders 3'-5" Stroke
Pickling Dept.
Foremans Office
8½" × 15"
10½" × 21"
12" × 18"
Shears
20" × 30"
18" × 30"
10½" × 21"
Shears.
Shears.
Shears
Coke Fired Annealing Muffle.
Coke Fired Annealing Muffles
Water
Shears
Shears
Water
Coke Fired Annealing Muffle
Coke Fired. Annealing Muffle.

FIG. 2.

10ft

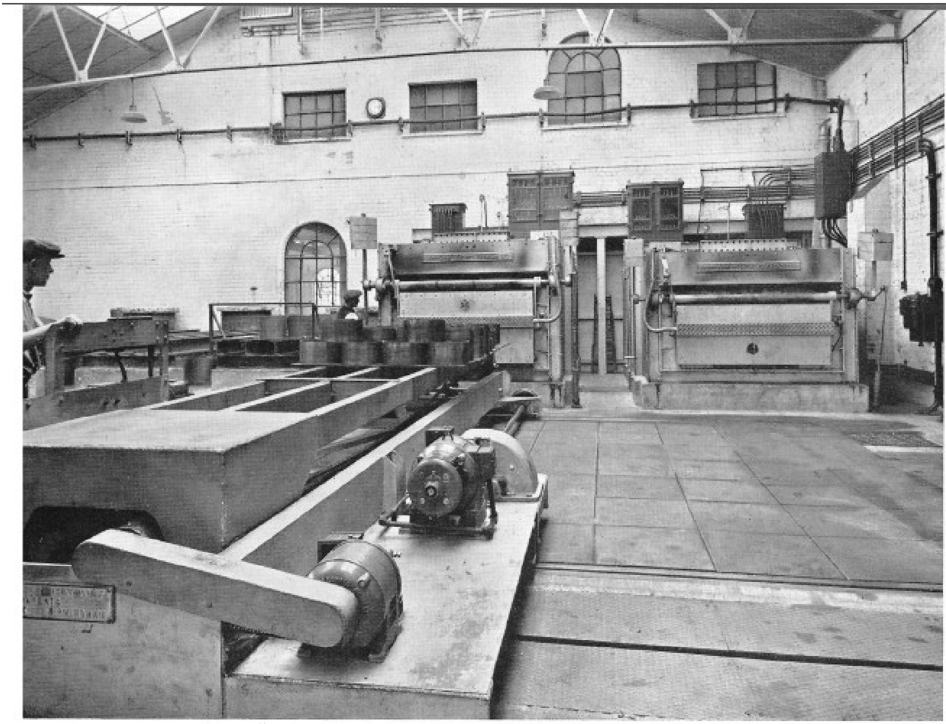
Early in 1911 the Wiggin rolling and wire mills took part in what afterwards became an important development in the field of light alloys, namely, the introduction into this country of the alloy known as “Duralumin.” The “Duralumin” patents in this country had been taken over by Vickers, Limited, who had acquired the works of James Booth and Company in Nechells for the production of “Duralumin” cast ingots and billcts, and arrangements were made with the Wiggin Works for the rolling and drawing of this maierial, an arrangement which continued for a number of years until the work was finally taken over by the Booth Works at Nechells.

The readiness of the Wiggin Company to undertake new and experimental development was at this time generally recognised by the trade, and a number of experiments in the rolling and drawing of various complex alloys, including not only alloys containing nickel, but special brasses and copper alloys, were carried out at Wiggin Street for other manufacturers.

It is of interest to record that at about this period the idea of using electric furnaces for the melting and casting of nickel and nickel alloys began for the first time to be considered feasible. Towards the end of 1911 Boeddicker discussed the matter with General Direktor Aschoff, who was at that time in charge of the Basse & Selve Works at Altena. The proposal, however, was for some reason dropped and it was not until some years later, i.e., during the War period, that experiments in this direction were actually carried out. These will be referred to later.

The enterprise of the Wiggin Company in dealing with new and special alloys out of the ordinary routine led naturally to attempts to improve the equipment of the Works, and the Company was one of the first to introduce the use of high-class precision rolling mills of the types then manufactured only in Germany. During the period 1910 to the outbreak of War several such mills were installed and also, what was equally important at the time, improved types of annealing furnaces were erected. The idea of using coke-fired producer gas for the heating of non-ferrous metals was at that time comparatively new, and here again the Wiggin Works were in the forefront in the adoption of this type of furnace.

The drawing in Fig. 2 gives an outline of the Wiggin rolling mill as it existed just prior to the outbreak of war. The mill was divided into two portions, each operated by a horizontal compound steam engine with a large flywheel, and a feature of the lay-out, somewhat unusual at that period, was that practically all the mills were arranged separately and not “in train,” although driven from one set of gearing. It will be noted from the illustration that the hot-rolling mill for sheets and cold-rolling mill for rods and small mills for narrow strip and tape, were housed in a separate section.



"Batch" type Electric Annealing Furnaces (Cold-Rolling Department).

THE outbreak of war in August 1914 created a sudden and altogether abnormal demand for ammunition metals, particularly for those required for small arms and machine-gun ammunition, i.e., cartridge brass and cupro-nickel.

The Wiggin Works inevitably became of vital importance from the point of view of the latter alloy, since, apart from the Government establishment at Woolwich Arsenal and one or two private manufacturers of ammunition, such as Kynoch, Kings Norton, and Birmingham Metal & Munitions, Henry Wiggin & Company was one of the very few firms which had any appreciable experience in the manufacture of the copper-nickel series of alloys.

War also created an insistent demand for refined nickel, as also for several of the special alloys for which the Wiggin Company had become known, particularly electrical-resistance materials. It was natural, therefore, that this Company should be one of the earliest to be taken directly under Government control.

Throughout the War the Company rendered invaluable service, not only in executing its own orders and by its own contractual obligations to the Government, but by co-operation with other works in special developments. One example of this has already been quoted, the production of cupro-nickel on steel, which at that time began to be an important factor in certain types of ammunition.

After the formation of the Ministry of Munitions the manufacture of cartridge brass and 80/20 cupro-nickel was brought under the control of a section of the Ministry, headed by Mr. Alexander Duckham, whose brother, Mr. Arthur McDougall Duckham, afterwards Sir Arthur McDougall Duckham, was one of Mr. Lloyd George's right-hand men. The co-ordination thus affected brought the production of such alloys as 80/20 cupro-nickel directly under this section of the Ministry, whose chief metallurgist at that time was W. R. Barclay, afterwards closely associated with the Wiggin Company.

Much of the work done in the collaborations thus created cannot for obvious reasons be detailed, but it is worth while mentioning that as one result of this contact with the Munitions Ministry the idea of utilising electric furnaces for the melting of these alloys was revived by Barclay and an arrangement was entered into with the Wiggin Company for collaboration in the rolling of electrically melted material. It was not, however, until the middle of the year 1917 that a suitable furnace could be erected and put into operation. In the meantime the problem of the accumulation of scrap had become acute and one of the earliest requirements of electric-furnace melting was to deal with these accumulations. The utilisation of scrap complicated very considerably the problems encountered in this new technique. Incidentally, it revealed in a striking degree the flexibility of the Heroult clectric-arc furnace when some measure of refining was required. The work done in this direction during the latter part of the War period undoubtedly laid the foundation for what may be justly described as the amazing development in electric melting which the post-War period has witnessed.

During the War period the Wiggin business, like many other similar businesses, had to face considerable difficulties in obtaining supplies of raw material, particularly for its refining operations of nickel and cobalt. Fortunately, ore stocks and stocks of other residues were always kept at a fairly high level and the works output was invariably up to standard. The invaluable services of the firm to the country at the time were often recognised by the Government officials concerned, and special tributes were paid to the high standard of quality produced at these works.

In the meantime, Boeddicker, who had successively acted as chemist, works manager and managing director, had begun to feel severely the strain of the War, following a previously long and active career, and immediately after the Armistice the Wiggin directors invited Barclay, who, as previously indicated, had been in close touch with the firm, to join the Company as assistant to Boeddicker.

In January 1919 Barclay intimated to the Wiggin Board his acceptance of the position, but owing to the requirements of the Government in clearing up the contracts of other works, it was not possible for him to take up his duties until the end of April in that year.

The ending of the War brought to the Wiggin business, as to many others, an entirely new set of problems. It was faced with considerable uncertainty as to supplies of raw material, and in the meantime competition in the nickel industry had become much keener owing to two factors—{a) the growth and development of the Mond Nickel Company, and (b) the very considerable imports of American nickel which had been brought into the country during the War.

It is not surprising, therefore, that towards the end of 1919 discussions should have taken place between the directors of the Mond Nickel Company and the directors of Henry Wiggin & Company on the possibility of devising some scheme of amalgamation of interests. The fact that during the same year, 1919, the Mond Nickel Company had itself acquired a rolling mill in Cliveland Street, Birmingham, for the purpose of manufacturing malleable nickel sheets and strip, further indicated the desirability of such an arrangement.

These discussions resulted eventually in the purchase of the entire shareholding of the Wiggin business by the Mond Nickel Company, payment being made partly in cash and partly in shares in the parent Company. This change of ownership naturally resulted in the reconstruction of the Wiggin Board of Directors—the only members of the Board retained being Mr. G. A. Boeddicker and Colonel W. H. Wiggin. Mr. Robert Mond (afterwards Sir Robert Mond), as representing the Mond Company, was appointed Chairman of the Board, and the undertaking thus became a subsidiary of the Mond Nickel Company.

From the point of view of the Wiggin business the change in ownership rendered inevitable very considerable changes in its industrial policy. The whole of the operations on the refining of nickcl were wound up, and contracts for the supply of refined nickel taken over by the parent company. The manufacture of salts of nickel for electro-plating and other purposes, which had been an important feature in the wet refinery at the Wiggin Street Works, was transferred to the Mond Company's works at Clydach, and the only refining operations continued at Wiggin Street were those relating to the production of cobalt metal, oxide and salts.

It was thus obvious that the future policy of the Wiggin business must be the production of semi-manufactured nickel and nickel alloys in cast, rolled and drawn forms, and under the newly constructed Board a vigorous forward policy in this direction was adopted. A survey was made of all existing commercial alloys of nickel and arrangements were made for a considerable enlargement of the Wiggin operations in this field. Nickel-chromium alloys, which by that time had assumed considerable industrial importance, were studied and their manufacture undertaken. It was during this period that the alloys since widely known as "Brightray," "Redray," ""Glowray," "Dullray," etc., were introduced. Amongst other products, several of the nickel-iron alloys were included in the programme. A few months after the reconstruction of the Wiggin business it was suggested by the Mond Board that the Wiggin directors should take over the control of the works in Birmingham referred to on p. 42 as being established by the Mond Nickel Company for the production of malleable nickel. The taking over of this work necessitated further changes, since the Wiggin business itself had already been established in this field.

It was not at that time feasible to concentrate the works on one site, and a division of activities was made, resulting in the establishment of a department for the production of pure nickel in sheet, wire and cast form at the Cliveland Street Works, and for all alloy production at Wiggin Street.

Although a certain amount of land and buildings had been set free at Wiggin Street by the closing of the nickel-refining operations, it was soon found necessary to enlarge the works there, and for this purpose a factory situated at the west end of Wiggin Street was purchased and cleared for the erection of a hot rod-rolling mill, a scheme being prepared at the same time for the transfer of wire-drawing operations to this site. The erection of this rod-rolling mill marked a development as important in its way as that effected by the transfer, in 1905, of the cold-rolling mill from the Bromford Works to Wiggin Street Works. The erection of the rod mill was speedily followed by the purchase of further wire-drawing machinery and the concentration of this machinery "in line of flow" with the rolling operations.

At this period the production at the Wiggin Strect Works included, in addition to the whole range of German or Nickel Silver Alloys, which had been a staple product from the commencement of the firm, a series of copper-nickel alloys ranging from 15 per cent. nickel and 85 per cent. copper to 70 per cent. nickel and 30 per cent. copper. The production of this series of alloys in the Wiggin business gave the firm a considerable standing and reputation in this field; it rapidly gained a foremost place also in the nickel-chromium field with the 80/20 per cent. and the 85/15 per cent. binary alloys, and several ternary alloys of nickel-chromium-iron. The binary alloys of nickel and iron, e.g., 25 per cent., 30 per cent., 36 per cent. and 43 per cent. nickel-containing alloys, were also included in the list of manufactures, and, in addition, an alloy corresponding to the Continental "Manganin," which is a copper-base alloy containing 12 per cent. manganese and 4 per cent. nickel, and having an almost zero temperature coefficient of electrical resistance. Nickel-manganese alloys containing 2½ per cent. to 4 per cent. manganese were also produced at the Wiggin Street Works.

In view of the vital importance of a number of these alloys for electrical purposes, an electrical testing laboratory was established and a considerable amount of industrial research work was undertaken in the development and improvement of these standard. products.

The progress made during the ten years 1920 to 1930, although not spectacular, was steady, and the records of every year during that period show the installation of additional machinery, mainly for cold-rolling and wire-drawing.

It is of interest to note that the firm was the first in Europe to adopt copper-lined, water-cooled moulds for the casting of nickel alloys, and also the first to adopt four-high rolling-mills for the rolling of sheets and strip. It was also among the first to install high-frequency electrical furnaces for melting. The progress made during this period indicated clearly the necessity of provision for further developments, and in 1928 the whole of the remaining land adjoining the Wiggin Street Works was purchased and plans prepared for the erection of new buildings and plant, including up-to-date sheet and strip hot-rolling mills specially designed for nickel and its alloys.

The erection of these hot-rolling mills, which was begun in 1930, marked a further important stage in the progress of the firm, and the plant embodied, as far as feasible, practically all notable improvements which had been made in rolling-mill design, including a number of features which had not previously been applied to non-ferrous metal practice. A full description, with illustrations, of this plant, by Barclay, Russell and Williamson was published in the *Journal of the Institute of Metals,* 1932 (2) pp.391 - 409, to which reference can be made by the interested reader. It need only be remarked here that the plant may be considered a landmark, not only in the history of the Wiggin Company, but in that of the manufacture and production of nickel alloys in general. On the completion of the new plant, the works at Cliveland Street, in which malleable nickel in sheet and strip form had been previously manufactured, were closed and the whole of the production of both nickel and its alloys concentrated in the Wiggin Street Works. This concentration enabled a number of detailed improvements to be effected in flow of operations and economy in power, as in other incidental costs, and in addition paved the way for a detailed study of the technique of manufacture in the various sections of the works, with a view to improvements in both quality and efficiency.

The year 1929, which saw the laying of the foundations of the new hot mill, was also a notable year in the history of the nickel industry generally, for in that year the amalgamation of the whole of the Mond Nickel Company's business and subsidiaries with those of the International Nickel Company of Canada was effected. This amalgamation, which made the Wiggin Company part of a world-wide organisation, strengthened the standing of the firm very considerably, not only financially and commercially, but industrially, by giving access to experience gained from American methods and practice.

In 1930 the programme of works-extension improvements, roughly outlined in the previous year, was considerably enlarged in scope, and from then until 1935 the progress of the Company, both in plant facilities and in improvement of technique of operations, was very rapid.

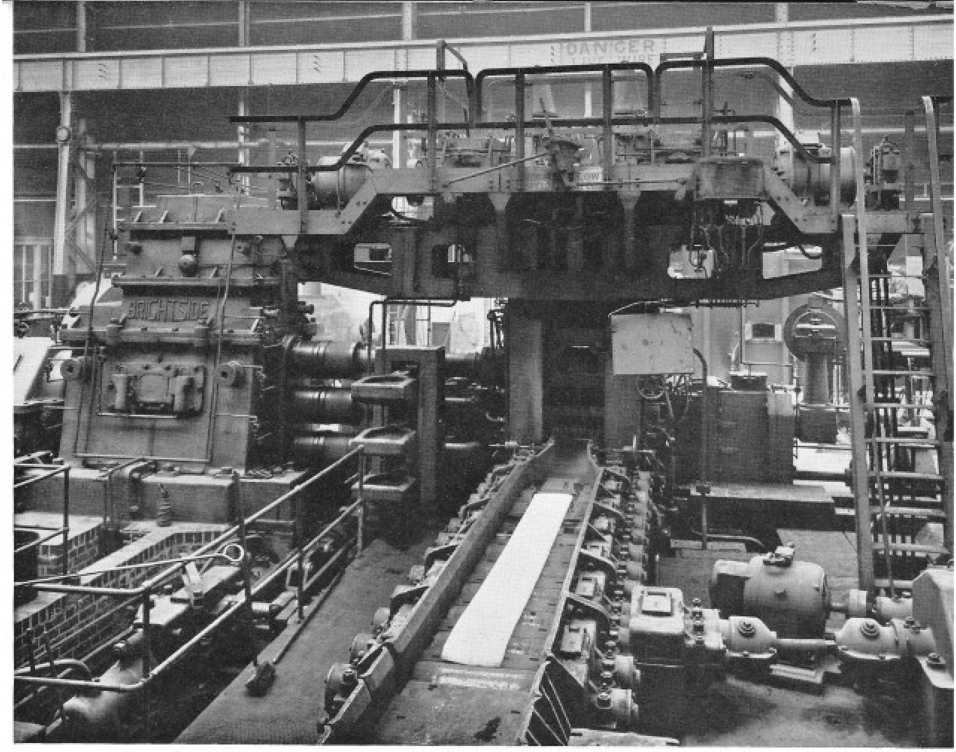


Fig. 3. 18-inch × 21-inch "Universal" type Hot-Rolling Mill.

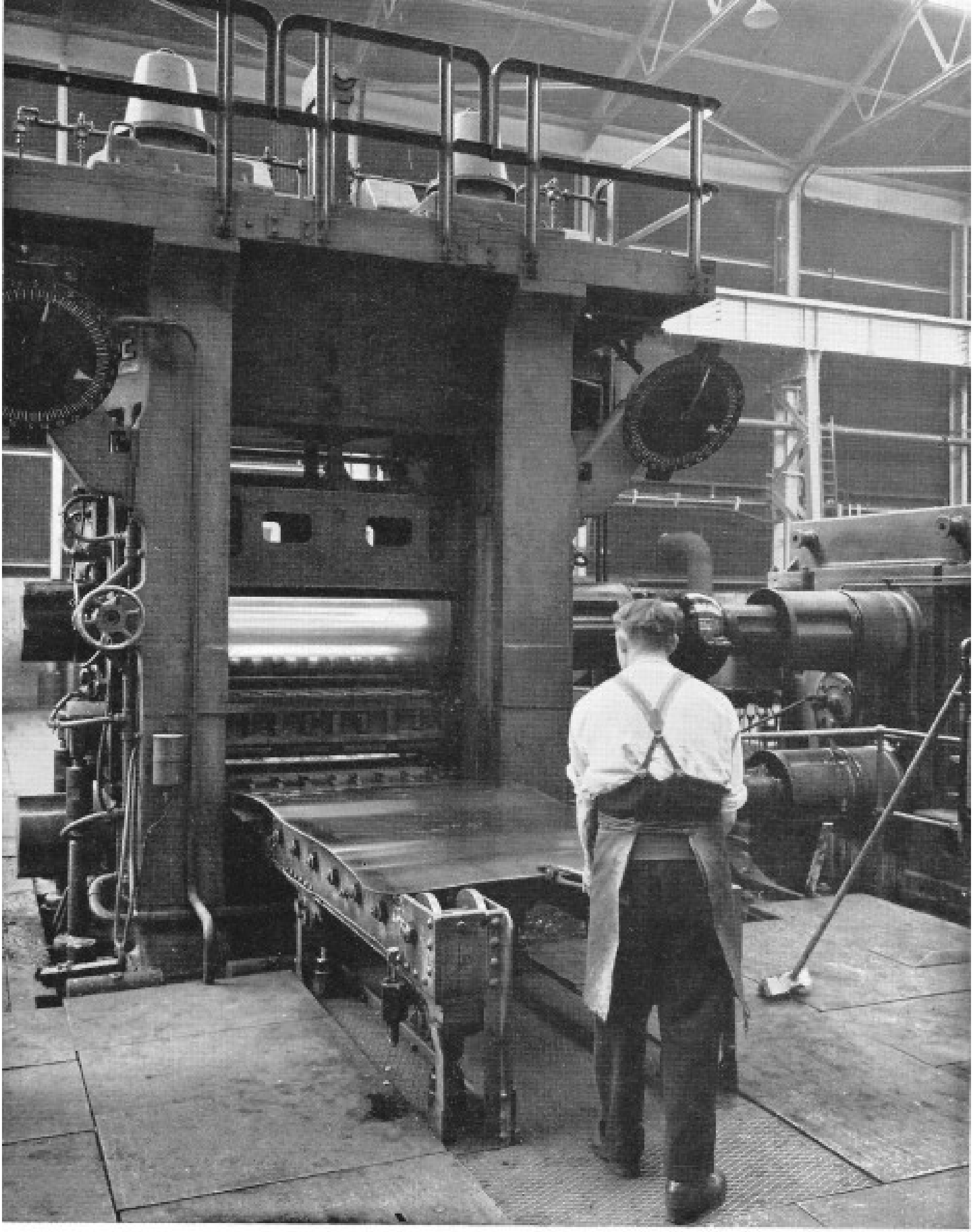


Fig. 4. 26-inch × 52-inch Hot-Rolling Sheet Mill (Lauth type).

In this chapter a brief description is given of the main improvements effected during recent years in plant and technique. These have resulted in an equipment second to none in Europe for its specialised purpose, i.e., the production of malleable nickel and the principal commercial nickel alloys in semi-manufactured forms.

HOT-ROLLING DEPARTMENT

At the end of the previous chapter reference is made to the new hot-rolling mills, and since these are a notable feature of the plant a short technical description of their design is given first place.*

The installation consists essentially of two mills:—

(*a*) an 18-inch by 21-inch three-high mill of the "Universal" type; and
(*b*) 26-inch by 52-inch sheet mill of the "Lauth" type.

(See Figs. 3 and 4.)

These two mills are arranged on either side of a common gear reduction unit, and are at present driven by a single 750 h.p. motor, which is adequate to operate one of the mills at a time (provision has been made for an additional motor when the output is sufficient to justify the running of both mills simultaneously). This reduction unit is designed to transmit a normal horse-power of 1,500 and peak loads up to 4,500 h.p. The gearing ratio is 9.6 : 1 and gives a speed of 61 r.p.m. to the final drive shaft. The gear unit itself is of the double reduction type and has a total weight of approximately 100 tons. Lubrication is effected automatically by a central gravity-return lubrication system, which also serves other sections of the mill mechanism.

(*a*) *The three-high "Universal" type mill*, as indicated, is fitted with 18-inch diameter rolls having a barrel-length of 21 inches. The vertical rolls, which are arranged at the side of first entry of the hot billet, have a diameter of 14 inches, and these rolls are carried in a novel fashion on the extremity of stiff rectangular rams sliding in guides cast with the roll housings.

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* For fuller description and engineering details, see *Jnl. Inst. Metals*, 1932 (2), pp. 401-407.

The rolling speed of the mill at the synchronous speed of the main driving motor is 300 feet per minute. The screw-down gear is of the two-motor type: each motor is connected to the worm gear operating one screw by a train of reduction gearing, but the two sets of gearing can be connected at will. The mill is controlled on the "push-button" method from a raised "pulpit," from which the control operator has a complete view of the working and rolling operations.

The normal product of this mill is sheet bar from which hot-rolled sheets can be produced on the "Lauth" mill, but both hot-rolled strip down to 1/8-inch gauge and square bars for subsequent rolling on wire-rod mills can also be produced. Tilting tables arranged on both sides of the roll stand are hydraulically controlled, and at the outgoing end automatic coiling and shearing equipment of a modern type is installed. The total weight of the "Universal" mill with tilting tables is 165 tons.

(*b*) *The three-high "Lauth" sheet mill* is intended for the production of sheets up to 48 inches wide, and at the present time it is used for both roughing down and finishing: plans are prepared for an added finishing stand, which will be installed in the near future.

This mill has been designed to roll sheet bar ranging up to 14 inch thickness and can produce either heavy sheets or light plates up to 12 feet in length. The top and bottom rolls have a diameter of 26 inches and the middle roll of 16 inches: all three rolls have a barrel-length of 52 inches. The normal speed of the rolls is 37 r.p.m., giving a rolling speed of 250 feet per minute, The screw-down gear is operated by a single 30-h.p. motor, and the design enables either simultaneous or independent operation of the screws. This mill is also equipped with hydraulically operated tilting tables. The weight of the mill is 170 tons,

The heating furnaces serving the hot-rolling mills are oil-fired and have been specially designed for this purpose, the aim being to obtain rapid heating together with a high degree of uniformity of temperature.

CASTING

The greater proportion of the production of cast ingots at the Wiggin Works is from electric furnaces of the Heroult are or Ajax Northrupp high-frequency type, but for certain alloys, e.g., nickel silver, which are of a considerable variety of composition, coke-fired crucible furnaces are still used.

The electric furnace equipment consists of:-
(*a*) a 3,000-Ib. capacity Heroult are furnace.
(*b*) a 1,500-Ib. capacity Heroult are furnace.
(*c*) a 1,000-Ib. capacity Ajax-Northrupp high-frequency furnace.

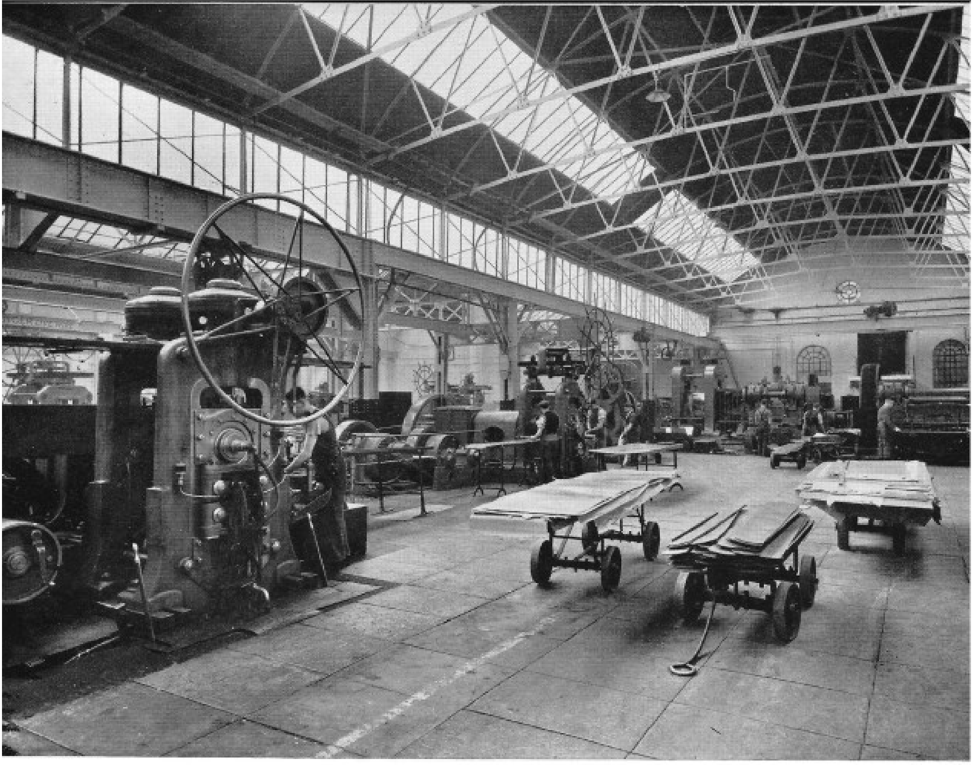


Fig. 5. Section of Cold-Rolling Mill (four-high mill in foreground).

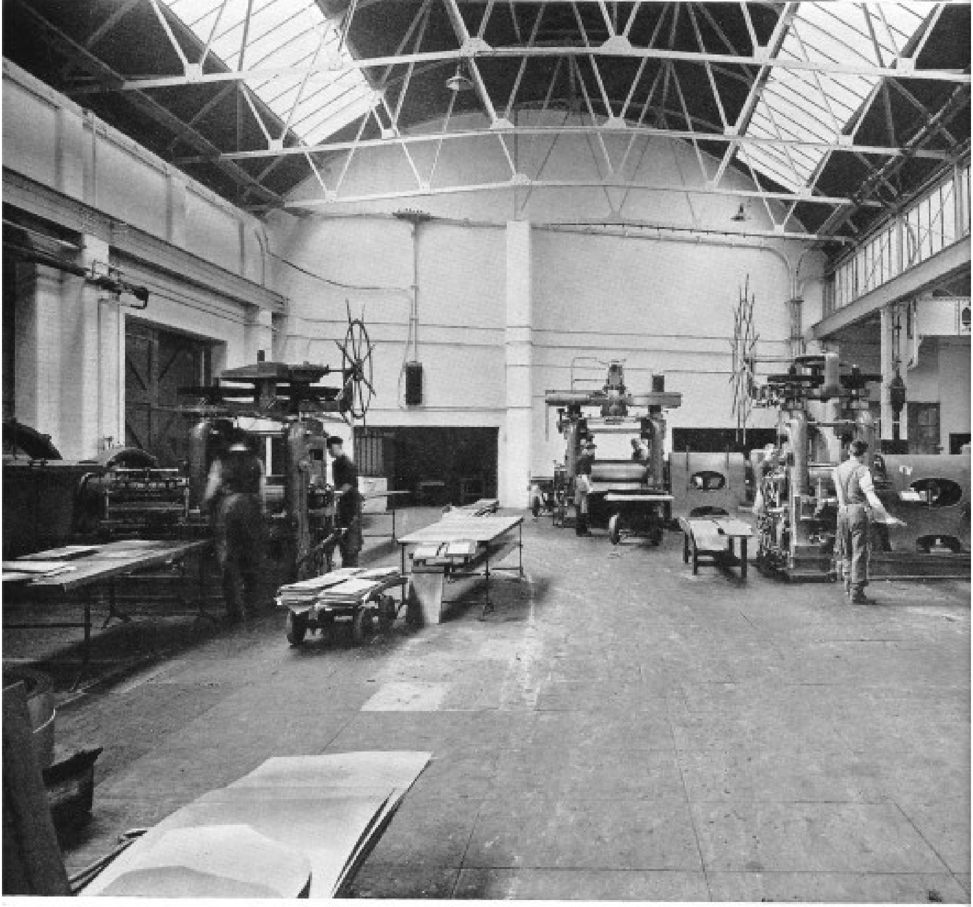


Fig. 6. Section of Cold-Rolling Mill (sheet and strip rolling).

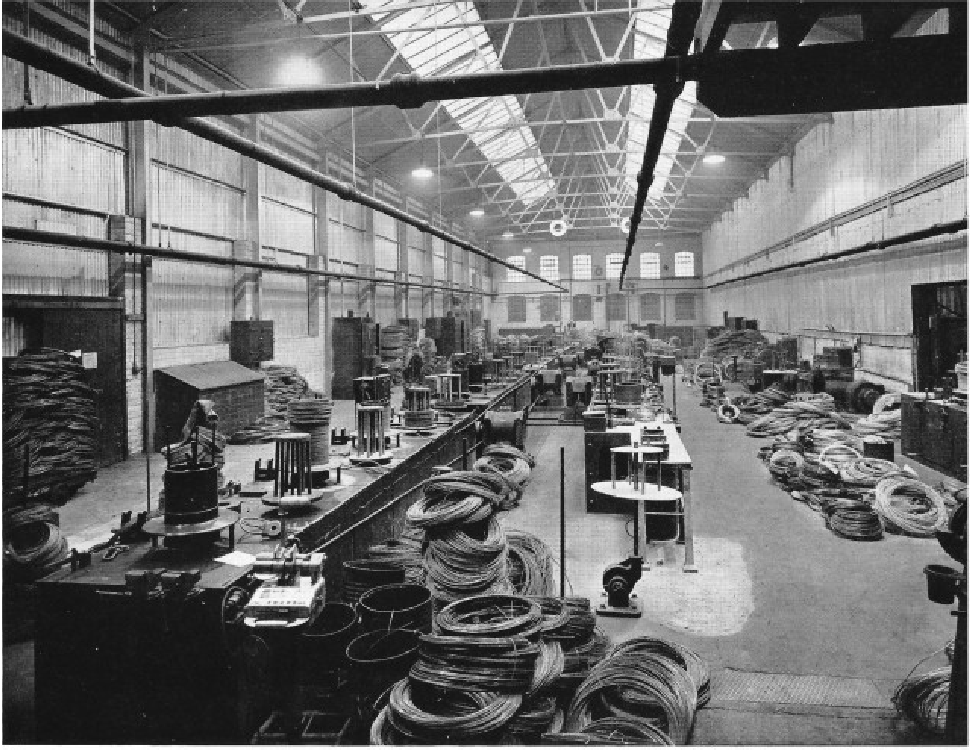


Fig. 7. Section of Wire Mill showing "Single-block" Machines.

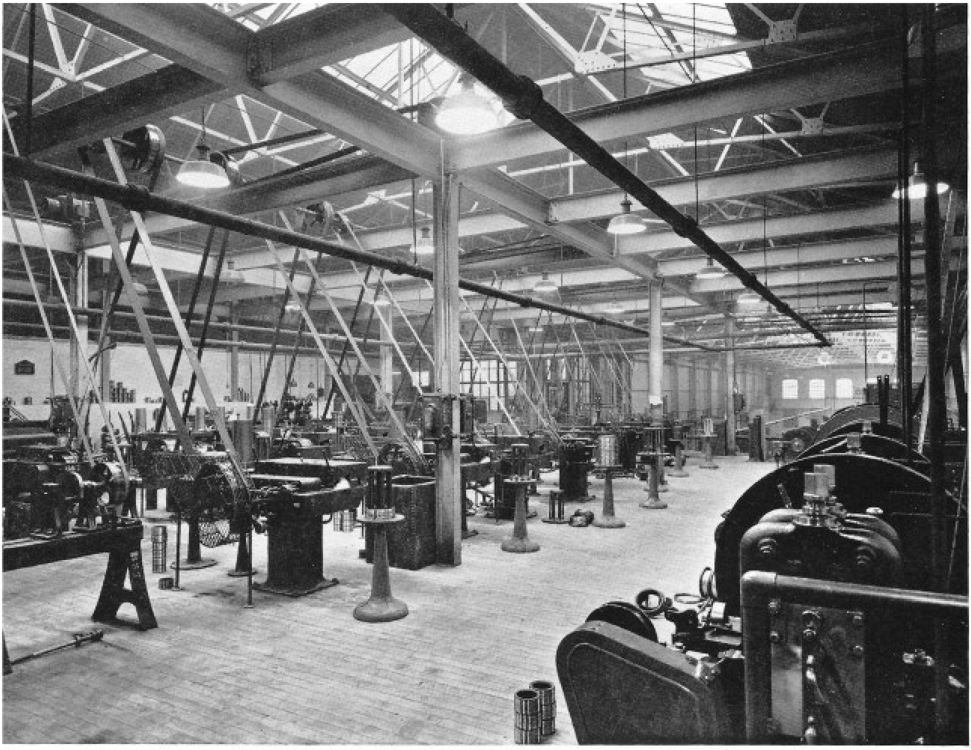


Fig. 8. Section of Wire Mill (Multiple Diamond Die Machines). Tape-Rolling Mill on right.

A second high-frequency furnace is under construction and will shortly be in operation.

The crucible furnace equipment is comparatively modern, and was put down some twelve years ago from designs by Wigley, the well-known Birmingham furnace architect-engineer.

Casting operations from the electric furnaces are carried out by means of bottom pouring ladles. The ingots produced vary from approximately 3} inches square (for rod and wire work) up to 10 inches square (for strip and sheet production). From the crucible furnace the metal is cast direct into copper-lined ingot moulds, which for the most part are of the Junker water-cooled type.

COLD-ROLLING

The cold-rolling department is equipped with a considerable variety of mills, including two-high, four-high and six-high (cluster) mills. The majority of these are high-grade "precision" mills and are capable of rolling all widths of strip and sheet from comparatively narrow tape (1 to 1½ inches wide) up to sheet 48 inches wide.

Figs. 5 and 6 illustrate part of the equipment of this department.

WIRE MILL

Figs. 7 and 8 illustrate two sections of the wire mill, the former (Fig. 7) showing a number of single-block machines for heavier gauges and the latter (Fig. 8) multiple (diamond die) machines for fine wire-drawing. A series of tape-rolling mills is included in this section, The plant and equipment throughout this department are thoroughly up to date and include inter alia a multiple machine by Hesse & Jaeger, designed to use any number of dies up to nine, in steps of "Brown & Sharpe gauge" reductions with a normal working range of fourteen to twenty-one standard wire gauge. This machine embodies a number of minor improvements in design and although originally intended to run at 350 feet per minute has now been speeded up to 585 feet per minute. Lubrication is effected by means of a high-speed centrifugal pump separately driven. A series of "Kratos" machincs has also recently been installed, for multiple drawing at speeds of 250, 350 and 480 feet per minute.

Other features of the wire mill equipment are welding machines (micro-welder type); tape-drawing and rolling mills; water-sealed electric furnaces (see Fig. 9) and a series of continuous (electric) furnaces for single-strand annealing in hydrogen and reducing atmospheres. See Fig. 10.

A brief technical description of the annealing furnaces is given on pp. 50-51.

SPOON AND FORK DEPARTMENT

An interesting product of the Wiggin Street Works, dating from an early period, is spoon and fork blanks for trade supplies. The sheet metal for this section is furnished by the cold rolling department and is passed through a series of stripping and cutting out machines. Cross-rolling mills and automatic stamps carry the blanks to the stage ready for the final buffing, electro-plating and finishing processes of the trade.

A section of the department, showing a number of “cutting-out” machines, is illustrated in Fig. 11.

CASTING OF NICKEL ANODES

It will be noted in the earlier portion of this history that the production of nickel anodes for electro-plating has been a regular feature of the firm’s activities for many years. In 1931 a new shop was built and equipped for this purpose and it is of interest to record that this contains the original electric-arc (Heroult type) furnace used in the earlier experiments in electric-furnace melting of nickel alloys (see p. 41).

A considerable variety of shapes and sections of cast anodes is produced in this department: a section of the lay-out is shown in Fig. 12.

ANNEALING FURNACES

In the production of nickel and its alloys of the types and standards of quality demanded by engineers and users to-day, annealing processes are of special importance. The high resistance of many of these alloys to oxidation and corrosion necessarily renders pickling processes both tedious and difficult. As a consequence the policy adopted in laying out the plant during recent years has been to cut down the necessity for pickling to a minimum, and to adopt as far as possible the principle of annealing in reducing or non-oxidising atmospheres.

A consistent effort has also been made to retain in the final product the high standard of finish produced by precision rolling on highly finished rolls.

Apart from heating furnaces for hot-rolled products, the Wiggin plant now contains approximately twenty annealing furnaces, nearly all electrical. They cover the annealing and heat treatment of sheet, strip, wire, tape and blanks, and are of the following main types:—

(@ Box-type batch annealing furnaces.
(b) Batch-type bright annealing furnaces.
(c) Continuous bright annealing furnaces.

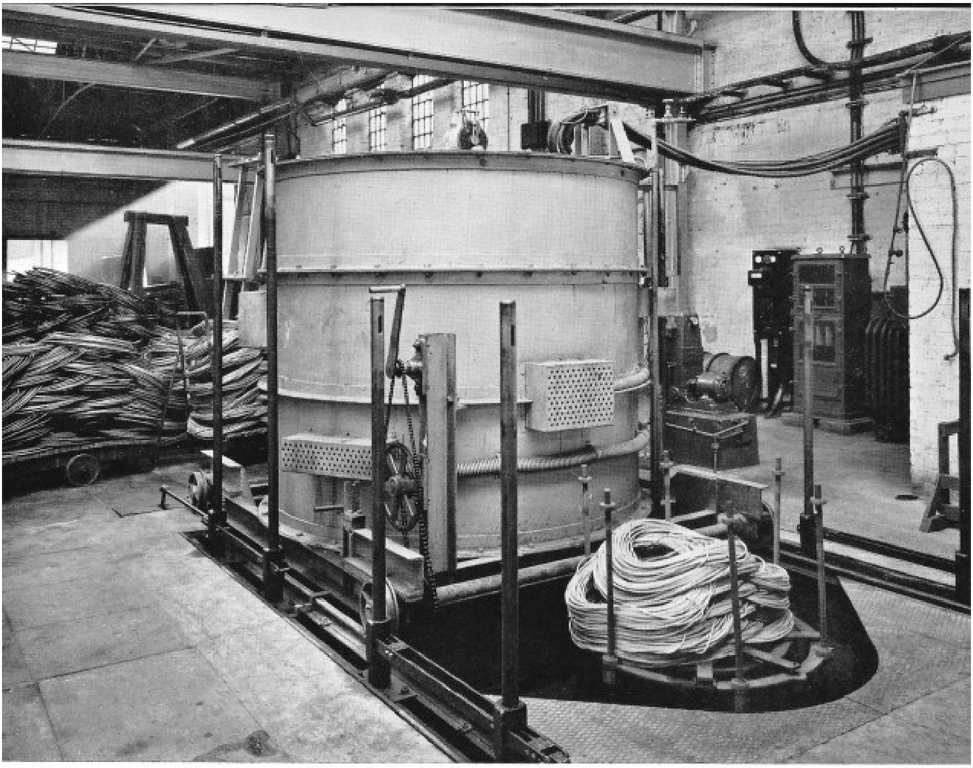


Fig. 9. Wire Mill Annealing Department, showing "Water-sealed" Furnace.

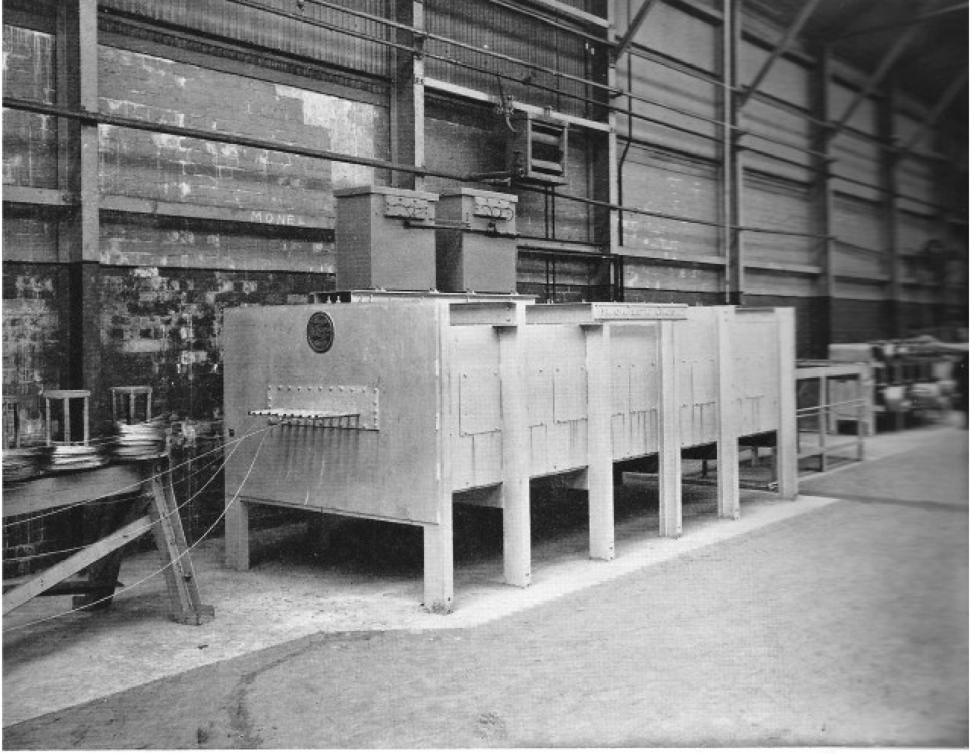


Fig. 10. Single Strand (hydrogen atmosphere) Electric Annealing Furnace.

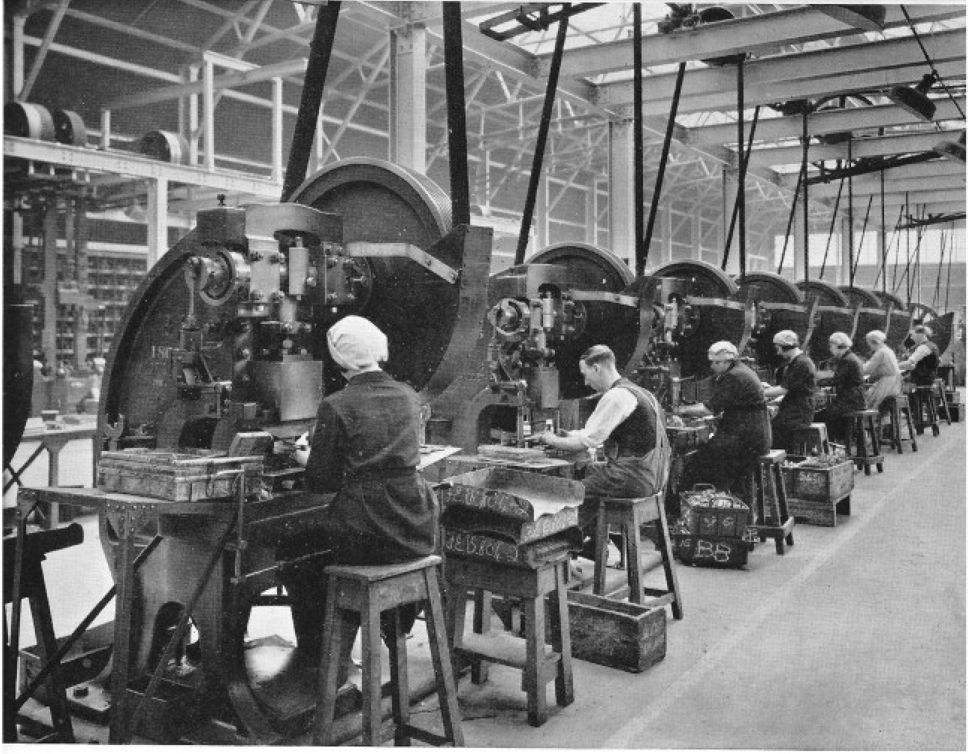


Fig. 11. Section of Spoon and Fork Department (Cutting-out Machines).

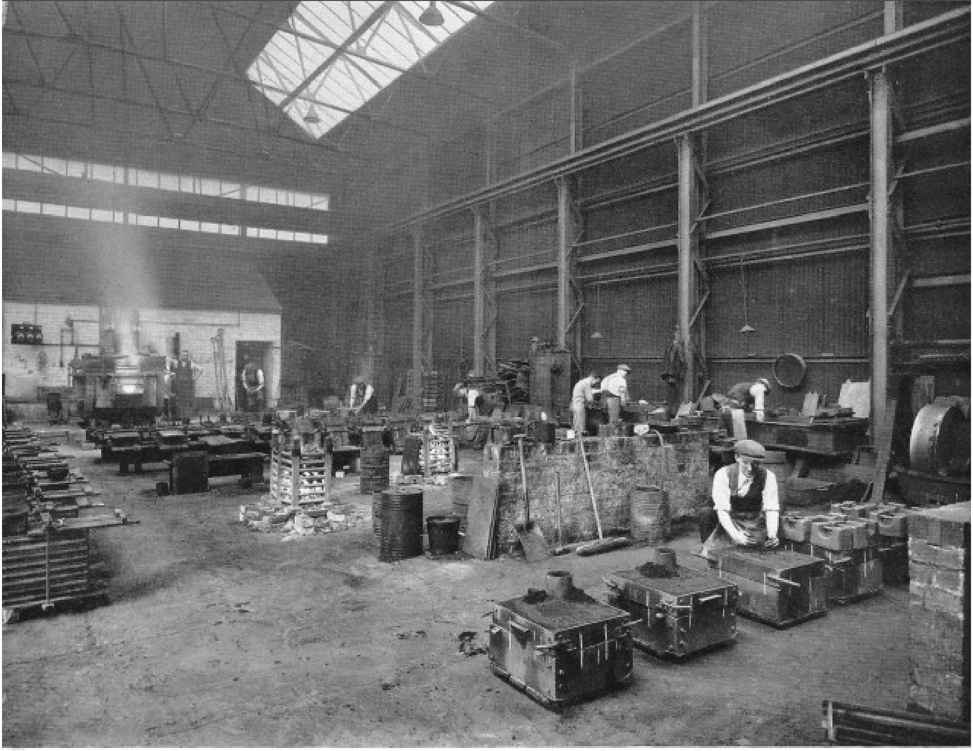


Fig. 12. Nickel Anode Casting Shop (Heroult Electric Furnace in background).

In the first category there are four installations, the largest of which is rated at 210 kW. and has a chamber 12 feet long by 5 feet wide by 1 foot 8 inches high. This and other similar furnaces are loaded by means of a mechanical charging machine and deal for the most part with coils of strip and wire.In the first category there are four installations, the largest of which is rated at 210 kW.
and has a chamber 12 feet long by 5 feet wide by 1 foot 8 inches high. This and other similar furnaces are loaded by means of a mechanical charging machine and deal for the most part with coils of strip and wire.

In the second category are included two “bell type” furnaces of different design, both of which are used for annealing wire in coils. In one the charge is enclosed in a gas-tight metal hood, under which an artificial atmosphere can be obtained to minimise oxidation. In the second the furnace chamber itself is made effectively gas-tight and annealing takes place in a steam atmosphere, the charge being inserted from below through a water-seal bath. This latter furnace is the larger of the two, and is rated at 100 kW. Its hearth is 3 feet 3 inches in diameter, with a loading height of 2 feet.

The continuous bright annealing furnaces may be sub-divided into two types, comprising “‘belt-conveyor” and “direct-handling” equipment. In the latter the material—in the form of wire or strip—is drawn continuously through the heating and adjacent cooling chamber by suitable coiling gear, no conveyor being required.

Examples of the “belt-conveyor” type include one for dealing with sheets up to 4 feet 6 inches wide, which is one of the largest of its kind in the country. The installation is rated at 250 kW. and has a heating chamber of 12 feet long. It is capable of an output of approximately 1,000 1b. of nickel or Monel Metal sheets per hour, and gives a perfectly bright finish on the material annealed by the use of an artificial atmosp! generated in a separate plant. A second similar furnace is in use, rated at 80 kW. only, with a heating chamber 10 feet by 2 feet 6 inches wide.

The continuous wire and strip furnaces include one for annealing continuously ten strands of wire simultaneously. This installation has a rating of 40 kW. and a heating chamber 13 feet long, and is capable of an output of approximately 14 cwts. of wire per hour.

One continuous strip furnace is used almost exclusively for nickel and is arranged vertically to conserve floor space (see Fig. 13). It is a small unit, rated at approximately 20 kW., and has a heating chamber of 6 feet long and is capable of taking strip up to 10 inches wide.

Nearly all the foregoing furnaces were designed and erected by the Birmingham Electric Furnaces Ltd. (an associated Company). A few special furnaces have, however, been designed and built by the Wiggin technical staff, particularly those used for the bright annealing of nickel-chromium alloy wires. A special feature in the design of these furnaces is the use of a nickel-chromium tube as the heating element, surrounding smaller diameter tubes through which the wire itself passes in a continuous process.

SUB-STATION

The electrical sub-station is an outstanding example of modern design. Special load requirements have led to unconventional features being introduced, while in other cases a deliberate break from tradition has been observed. For the low-tension connections between transformers and busbars, for example, bare copper bars encased in sheet steel trunking have been employed instead of cables. The chief features of the design of the station are elasticity of switching arrangements, adaptability to extreme variations in load conditions, the insurance of continuity of supply, easy access to cables and switchgear, arrangements for facilitating the moving of heavy parts, the provision of extra feeders as and when required without the necessity of disturbing existing circuits, the complete enclosure of all “live” metal, both high tension and low tension; adequate. protection of circuits subjected to heavy peak loads and the ability to deal with very heavy currents. The capacity of the station is 6,000 kVA., which can be increased by 25 per cent. There are four transformers, each of 1,500 kVA., operating at 11,000/400 volts at 50 cycles. The distribution is 3 phase, 400 volts at 50 cycles for both power and furnace requirements. The station is built in white glazed brick and served by a 10-ton crane.

It will be of interest here to give an idea of the electric power supply which is necessary to maintain the works at its present pressure of output. The number of motors, excluding fact’onal h.p. motors, is 300, with a total rated horse-power of 6,700. The number of furnaces is twenty-four and their total rated kVA. is 2,918. In addition, there is an actual lighting and heating load of about 250 kW. The annual consumption has risen at a remarkable rate since 1931.

The figures are:— 1931 .. .. .. 2,712,230 units,
1934 .. .. .. 6,128,000 units.
1935 .. .. ..7,532,100 units.

AUXILIARY PLANT AND EQUIPMENT

Amongst the most notable features of the present-day equipment at the Wiggin Street Works are a number of auxiliary machines, which in many cases have been specially: designed for the production of nickel and its alloys. Short notes on some of these are given below.

(a) A heavy stretching machine capable of dealing with sheets of 14 feet long by 4 feet 6 inches wide. The machine is operated hydraulically and the sheet is held in jaws which can be quickly adjusted to its length by means of two motor-driven nuts, on the long screws shown in the illustration Fig. 14. A maximum pull of about 380 tons can be obtained.

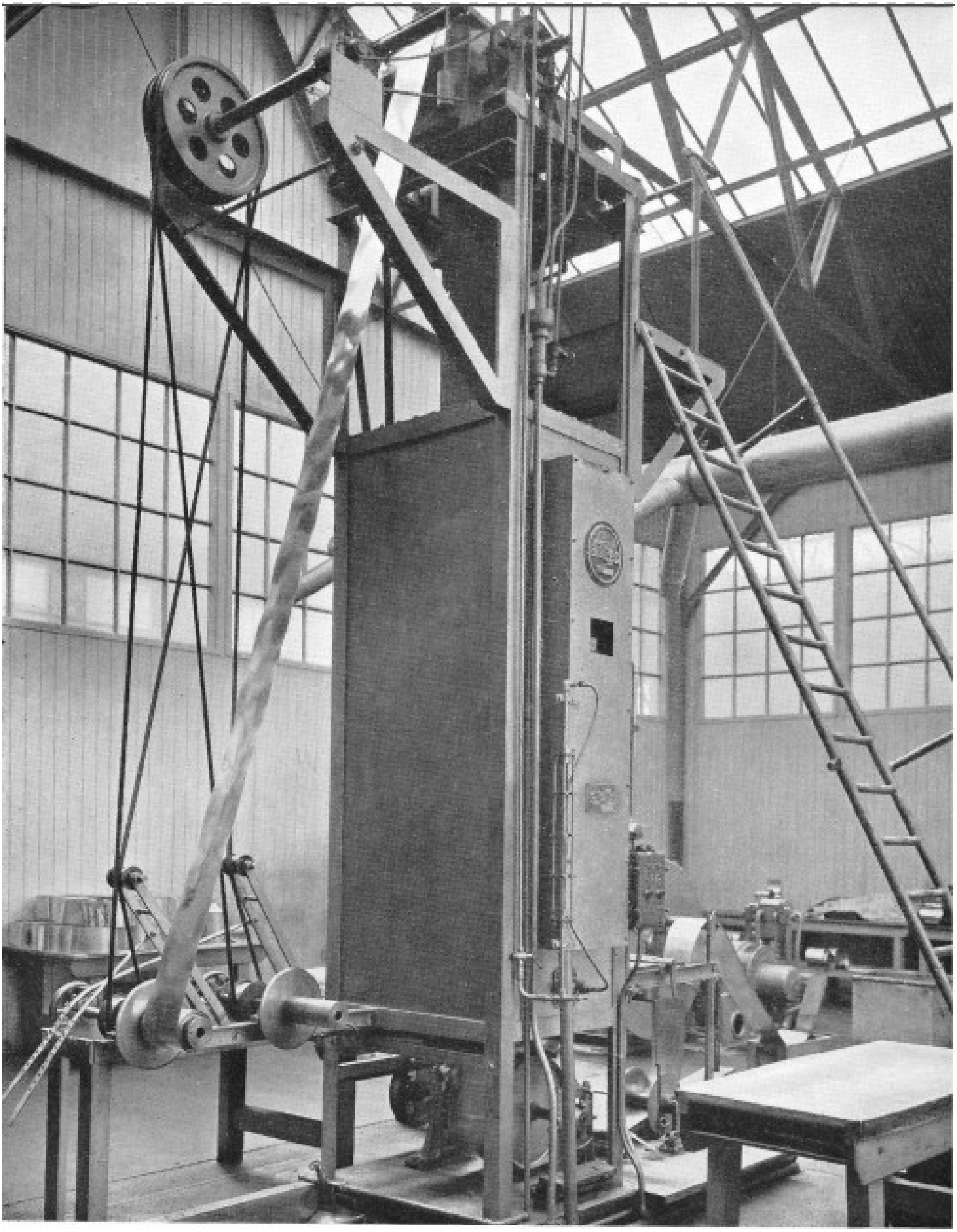


Fig. 13. Vertical Electric Annealing Furnace.

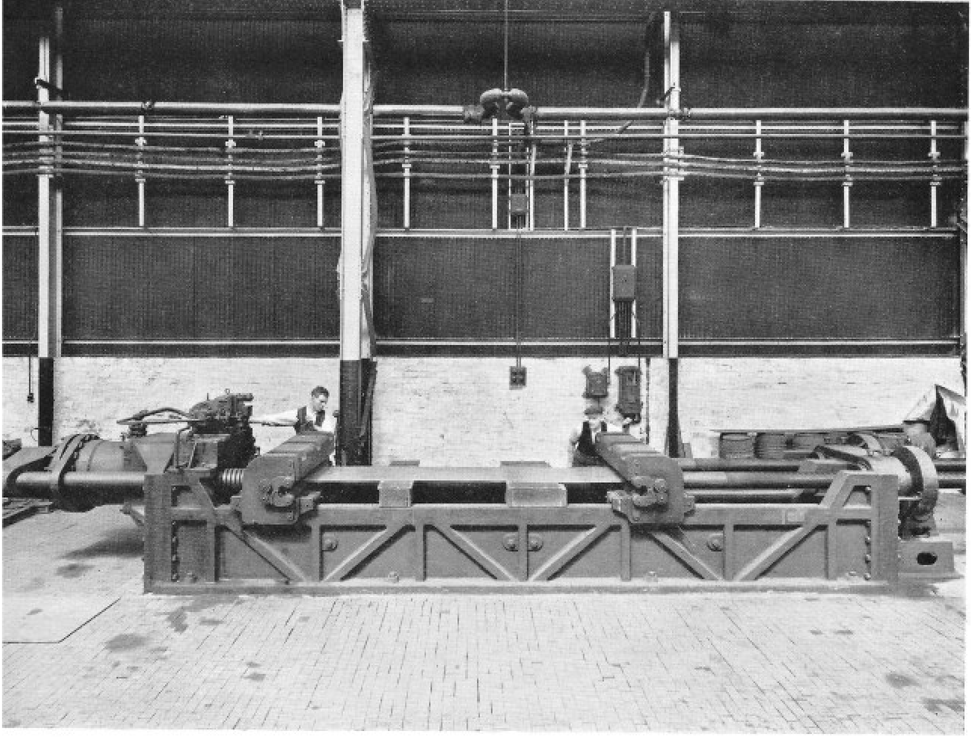


Fig. 14. Stretching Machine (Sheet Metal).

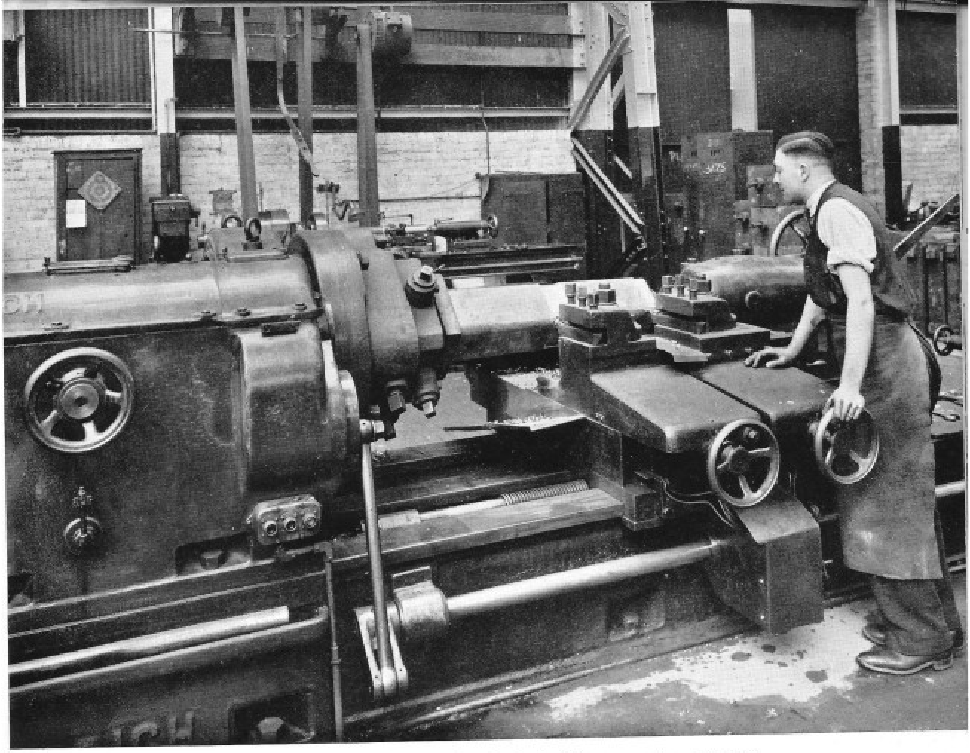


Fig. 15. "Waldrich" Square Turning Lathe (for preparation of ingots).

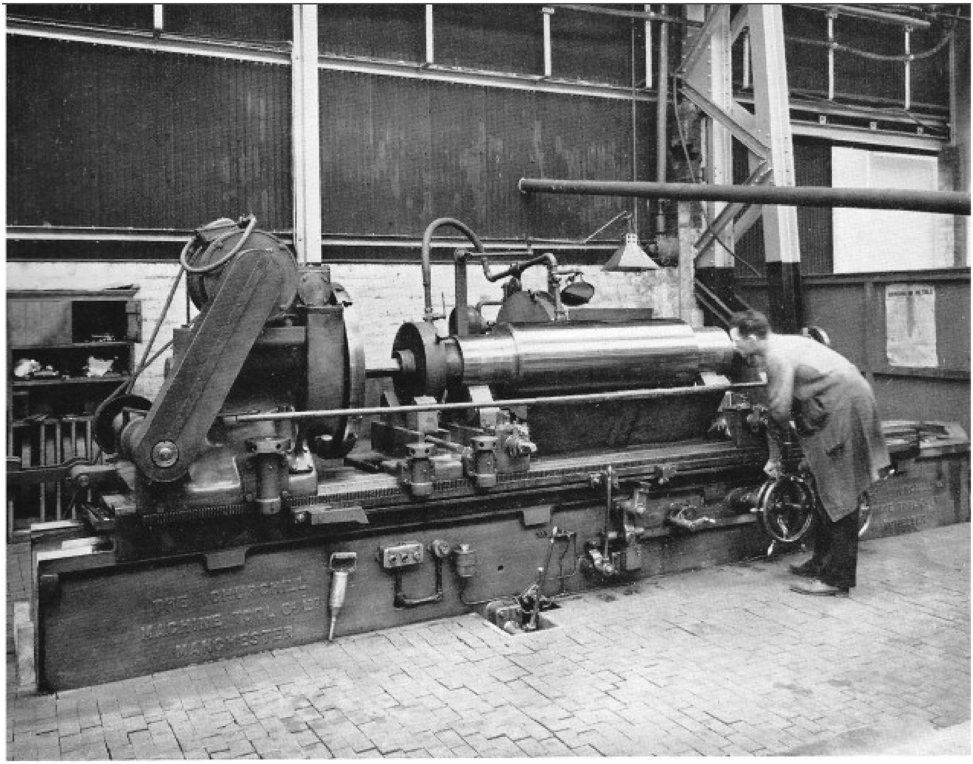


Fig. 16. "Churchill" Roll Grinding Machine.

(*b*) In order to achieve the highest possible surface finish on ingots before rolling, every ingot intended for sheet-metal production is machined on each surface, and the plant for this purpose consists, in addition to ordinary milling machines, of two special machines deserving mention.

The first, illustrated in Fig. 15, is a Waldrich square turning lathe capable of machining in one operation the four flat sides of the ingot while rotating. A reciprocating movement is imparted to the slide rests by means of a “cam” having the same length and contour as the ingot. This machine is fitted with a change speed gear-box and operated by a 25-h.p. motor.

The second machine is a Herbert milling machine of the vertical type used for machining 8-inch to 10-inch square ingots. This machine is capable of taking heavy cuts at a high speed, the cutter head carrying fifteen volute cutters of special high-speed steel.

(*c)* For the elimination of flaws and other defects discovered during rolling operations, a well-equipped fettling shop is also installed in close conjunction with the hot rolling mills. This department is fitted with air-compressing equipment, serving fifteen chipping hammers working together. The air pressure, automatically controlled between 80 and 100 lbs. per square inch, is provided by a twin-cylinder single-stage compressor driven by a 65-h.p. motor.

Since an important factor in producing high-grade hot- and cold-rolled sheets is the finish of the rolls, two high-grade roll-grinding machines have been installed, of which the larger is illustrated in Fig. 16. This machine can treat rolls from small sizes approximately 5 inches diameter by 8 inches long, up to a diameter of 38 inches by 120 inches in length. Both chilled iron and steel rolls can be ground to very fine limits and made parallel, or cambered in each direction.

ARTESIAN WELL

The change-over from crucible to electric-furnace melting and the installation of water-cooled moulds, together with an appreciably increased turnover, has led in the comparatively short period of three years to an increased consumption of water from 29,000,000. gallons per year to 46,000,000. As a result of this it was decided in 1934 to sink an artesian well, which is now completed and is meeting every demand. The well has a twelve-inch bore and is equipped with an eight-stage centrifugal pump delivering 15,000 gallons per hour into a tank of a capacity of 18,000 gallons. The total depth of the well is 503 feet, and the water, which is of excellent quality, leaves the well at a constant temperature of 53°F.

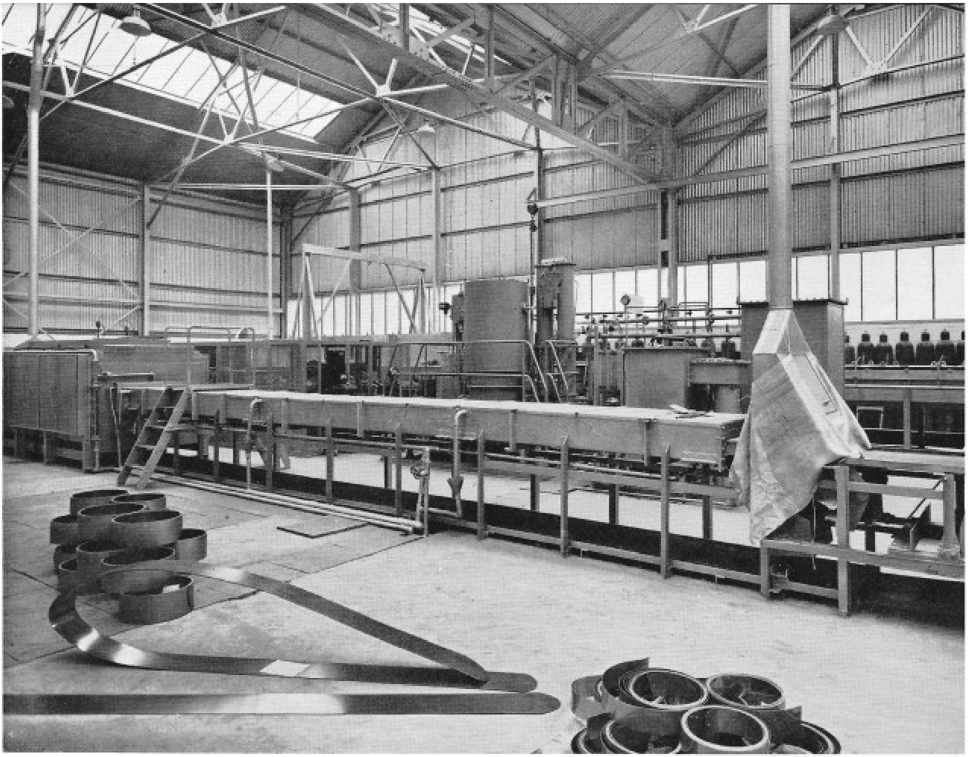
The foregoing description of the plant and equipment at present in the Wiggin Street Works, Birmingham, is necessarily somewhat seriously condensed, but it is hoped that it may convey a reasonably clear idea of the standard and scale of operations existing in 1935. It should be emphasised, however, that continuous experimental and development work is being carried on by the Company, and that improvements in methods, plant and equipment, are systematically introduced on the basis of the results of investigations made. For example, as these closing remarks go to press, plans for new hot- and cold-rolling mills and extrusion plant are being prepared.

The motto of Henry Wiggin & Company Limited is, indeed, that of the City of Birmingham itself, namely:-

"FORWARD"

Arms of the City of Birmingham,
Granted to the Corporation
April 1889.

Arms of the City of Birmingham,
Granted to the Corporation
April 1889,



Continuous Sheet and Strip Electric Annealing Furnaces (reducing atmosphere).

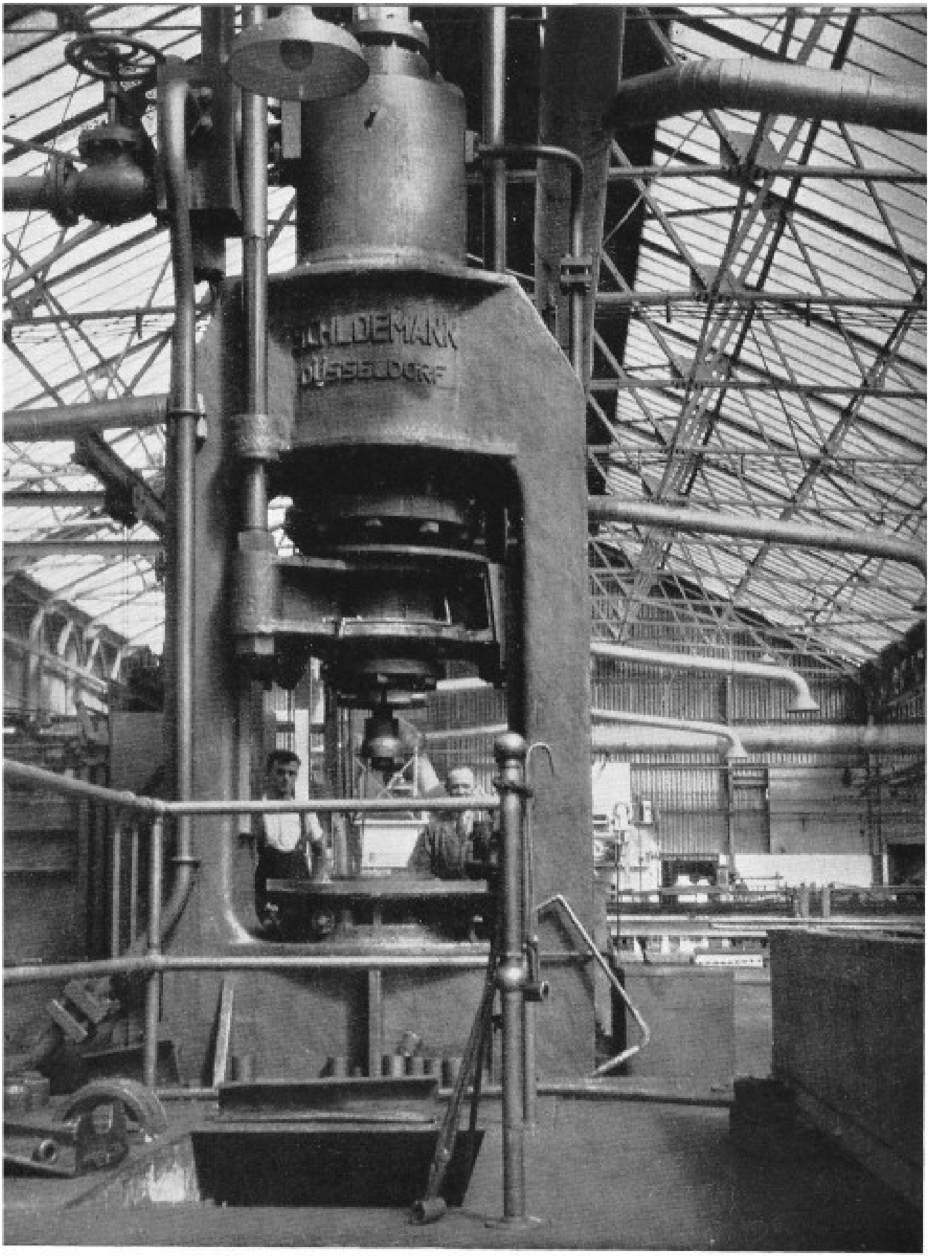


Fig. 17. View of Extruding Press in Zenith Works.

ZENITH WORKS, GLASGOW

Towards the end of 1932 Henry Wiggin & Company acquired the Monel Metal business carried on in Glasgow by Monel-Weir Limited, which specialised in sheets, strips, rods, wire, tubes, and turbine blading in Monel Metal, and some analogous nickel-copper alloys.

For some years the Monel-Weir Company owned a rolling and wire-drawing plant situated near to the works of Messrs. G. & J. Weir, who a short time previously had erected on separate ground, known as Zenith Works, a new building in which a modern tube production plant was situated.

On the acquirement of the Monel Weir Company by the Wiggin organization, the Zenith Works were taken over, and practically the whole of the manufacturing sections of the business were concentrated there. Considerable improvements and additions have been made, and the present plant contains:—

1. Vertical extruding press, by Schloemann, on which appreciable experimental work in the development of extruded sections of nickel alloys has recently been carried out.

2, Drawing benches for tubes, rods and sections.

3. Modern annealing equipment, and

4. Auxiliary plant for the production of specialities such as turbine blading and rolled sections.

The operations at Glasgow are carried out in close technical co-operation with the Works in Birmingham, and in addition to Monel Metal itself, which is the chief product, a number of special alloys of nickel in various forms are in production.

An illustration of the vertical extruding press is shown in Fig. 17.

A series of functions was held during the month of May, 1935, in commemoration of the hundredth anniversary of the foundation of the Company. Chief amongst these were the presentation in the Works of long-service awards to nearly one hundred employees on Thursday, May 16th, and a formal luncheon held at the Grand Hotel, Birmingham, on Friday, May 17th.

SPEECHES MADE AT PRESENTATION OF LONG SERVICE AWARDS

Opening the proceedings, the Chairman, Mr. D. Owen Evans, M.P., said:

"This year we are a hundred years old, and I think everybody will agree that in this series of celebrations which we are commencing to-day it is appropriate and proper that we should put this event first on the list. We are anxious to show our appreciation of the long service put in by a very considerable number of employees. I think it is not often realised that continuity of employment is not only good for the men themselves, but it is essential for the prosperity of a business, We have passed, and we are passing, through a great crisis in our industry in this country. We hope we are, and I think we are, emerging from that crisis. Employment is on the increase in the country. We have known, and all workmen and all those who are employed know, how demoralis-ing it is to men to have long periods of unemployment. There is nothing so detrimental to the efficiency of workmen, and there is nothing so damaging to the factory itself, that is to say, to the business itself. To rely on casual labour, labour which comes and goes, is a bad thing for any industry, and it has been therefore our aim and it is our aim now, to create such conditions of employment as are conducive to the retention of trained and capable workmen.

"We are about to honour to-day what T might term the gold bloc, represented by fifteen employees, and their total combined service to the Company amounts to 643 years. If you will work out a simple problem of arithmetic, you will find that averages forty-three years' service of each of them. We are also honouring what I may term the silver bloc, and their total of service amounts to 2,066 years.

"Now, as I have said, our aim has been to create such conditions that we want to retain our men. 'We cannot have properly trained men if they come

and go. We cannot have efficient working in the mills unless we have men in constant employment who remain with us. It is for that reason, Mr. Stanley will probably tell you, that we have established a Pension Scheme, and up to to-day, although it has not been in operation more than a few years, we have paid our workmen, or their representatives, rather, about £3,600 in death benefits, and there are at the moment thirty-seven employees, old employees, on the pension list. I regret to hear that some of those who are on pension, and who were to have received gold watches to-day, are unable to be with us through illness and disability. There is a trinity in all industry—the directorate, the management, and the employees. Without complete goodwill in that trinity no business can prosper.

"Now [just wanted to say these few words as an introduction to this most interesting ceremony, and I am sure we are all extremely glad and proud to have with us to-day Mr. Stanley, the President of the International Nickel Company of Canada. J understand that Birmingham, the city of Birmingham, the great city of Birmingham, the city which bred Mr. Joseph Chamberlain, has a great and wide imperial outlook. It is therefore very gratifying to have with us to-day the President of a great imperial concern, and I now have very much pleasure in calling upon him, and upon Mr. Bailey, to assist in the ceremony, to present these tokens of appreciation to our workmen for long service."

Following the presentation, Mr. Stanley said:

"I need hardly tell you how pleased I am to be with you to-day. This is the first opportunity that T have had to address you personally, and I am gratified that it should be on such an auspicious occasion. Nothing gives me greater pleasure than to take part in a ceremony which pays tribute to the long and faithful service of our employees,

"I may tell you 1am myself a long-service man, having completed thirty-four years with this Company, of which nineteen years were spent in the plants. Naturally 1 am interested in what concerns the Company's employees, and I heartily congratulate those whom we are honouring to-day for long and loyal service. The success of the Company, in the future as in the past, depends upon the wholehearted co-operation of the workmen, the management and the directorate. I feel that each of you possess the spirit of co-operation, and that you work together as a unit, recognising that no one department can hope to bring success to this business without the loyal backing of the other departments.

"After several years' reconstruction you have the good fortune of working in a plant which is second to none of its kind for its equipment, and certainly for its organisation. | have watched your progress with close and personal interest, and in spite of repeated trade sct-backs my confidence has been vindicated. The rebuilding and re-equipping of this plant has been continuous throughout a period of unprecedented world depression, calculated to deter even the most optimistic. Nevertheless we held to our programme, and our policy proved to be justified when the tide eventually turned.

"All of you have contributed your share towards the maturing of our plans, and you have, in consequence, enjoyed regular employment during the lean years while so many others in this and other countries have had to face enforced idleness. I believe that the Company's business will continue to grow, and that you can hopefully look forward to enjoy in the future a feeling of greater confidence and more regular employment than falls to the lot of a good many. We recognise the important role which our employees fill, and it is our desire to create a sense of security amongst them. With this in view the International Nickel Company inaugurated its retirement system, and when the merger with Mond and Wiggin took place it gave me the greatest personal pleasure to extend the benefits of this system to all employees on this side. It is to me gratifying to hear, during my annual visits, that this system has already proved beneficial to many employees.

"You should realise that we are making constant efforts to improve our business. This necessitates the expenditure of large sums of money on research and development, and on new processes with which to improve the quality of our products. You are part of a sound and progressive enterprise, whose reputation for quality and service depends largely on the efforts of each of you, a point which I have already stressed.

"Let me, in conclusion, express my great satisfaction with what has been accomplished. My hope is that in the future your splendid record will be maintained. I trust that the functions which have been arranged in celebration of this centenary will make 1935 a memorable year in the lives of all present,"

Moving a vote of thanks to Mr. Evans and Mr. Stanley, Mr. A. P. Hague said:

"It gives me very great pleasure indeed to have the opportunity of proposing a vote of thanks, first to you, Mr. Chairman, for so kindly presiding, and secondly to Mr. Stanley for so arranging his European trip that he could be here to-day. I feel that no person is more fitted 1o make the presentation of watches than Mr. Stanley for, as he has told you, he himself devoted the greater part of his career to the nickel industry. He has been in the industry thirty-four years, nineteen years of which he worked as an operator. That he should have commenced in that way and become President of our vast interest is itself a tribute to his own unremitting and loyal service to the Company.

"One fact I would like to refer to which I know will be of great interest to you who realise how important Monel Metal is becoming in our business. It was Mr. Stanley who was responsible for the first heat of Monel Metal produced, and it must be gratifying to him to see the progress that metal has made, and is making, since its early days, What I would like to emphasise, however, is the great interest the Chairman of our Company and the whole of the directors, takes in all matters affecting the workers. I have been privileged to witness at first hand the great concern that they always have for your welfare, and I can assure you that no changes, or new developments of any of our plants are ever put into effect without due consideration being given in the very first place by both our President and Delegate Director to their effect upon the employees.

"We have heard already the benefits of the retirement system. There are numerous other beneficial institutions for which we are indebted to them. I believe I can truthfully say one could not wish to work with a more considerate President and Board of Directors, or with a more loyal and efficient band of employees. In proposing this vote of thanks, I am sure you will join with me in wishing our President and our Chairman to-day may long be spared to continue to direct the affairs of the Company to which we are all proud to belong."

SPEECHES MADE AT THE FORMAL LUNCHEON ON MAY 17th

Rising to open the proceedings after lunch, the Chairman, The Rt. Hon. Lord Weir of Eastwood, P.C., G.C.B., said:

"My duty this morning is a simple and very pleasant one. These are days when the tempo of life makes abbreviation both necessary and fashionable, so on behalf of the parent Company, known as INCO to its friends in the business world, and to its friends on the Stock Exchanges as 'Nickel,' I wish to extent to all our guests a most cordial and whole-hearted welcome.

"During the past fortnight we have all been taking our part in the celebration of the semi-jubilee of our Sovereign, King George, and his gracious Queen, so it is in keeping with the prevailing atmosphere that we should be meeting here to-day to celebrate the centenary of INCO's eldest child—Henry Wiggin & Company. It is a literal case of the child being father to the man, because Henry Wiggin & Company dealt in nickel long before its parent was born. We are told that it is a wise child that knows its own father, but surely it is a much wiser child which has had the foresight to select a parent with such distinguished imperial lineage as INCO.

"It is very gratifying to find that this lusty and venerable youngster, whose centenary we are met to celebrate to-day, has made so many loyal and steadfast friends, and we are doubly pleased that so many of them are able to be with us and to participate in to-day's function.

"I need not remind you that nickel has a number of most remarkable attributes. Like the patience of our people with their politicians, it has a high elastic limit. In these days of alarums and excursions it has that valuable quality, resistance to attack from the air, and above all, it retains an appearance of brightness and cheerfulmess under circumstances even of a depressing kind, so that if it is not exactly the philosopher's stone it comes near to being the philosopher's metal. Now, in this nickel business we are staunch believers in the delegation of function. We always try to get somcone else to do the work, even on these ceremonial occasions. Accordingly, my next duty is to introduce to you our very distinguished guest, representing the Government of our country, my friend Dr. Burgin, Parliamentary Secretary to the Board of Trade.

"Although we are not always articulate on the subject, we all know what a really good Government we have, In less than four years it has so surely guided and directed us that to-day we have much reason to be proud of our financial stability and economic security. In the matter of trade, I would only point to this city of Birmingham, which is at present one of the busiest in Great Britain. In achieving this state of affairs the Board of Trade and Dr. Burgin have played a prominent and important part, and we extend to Dr. Burgin to-day a very warm welcome and our most cordial thanks for the interest he has shown in our activities by coming here to speak to us to-day. He will say something to us on trade and industry, and I may mention that among his many accomplishments Dr. Burgin is a fine linguist. 1

can speak of this from personal knowledge, as he went up to Glasgow recently and gave an address to my fellow townsmen and they understood him perfectly. I have much pleasure in calling on Dr. Burgin."

Proposing the toast of "Trade and Industry,"
Dr. E. L. Burgin, M.P., Parliamentary Secretary
to the Board of Trade, said:

"I have to propose the toast of 'Trade and Industry." Lord Weir, in his Glasgow story, reminds me that in Parliament we have the Clydesiders often with us. At a country house, recently, the owner having received a consignment of rather small Havana cigars offered one, through the butler, to a guest, and the butler was heard to mutter 'Seems to think he is entitled to the whole cabinet.' I rather feel from this gathering to-day that instead of having a Junior Minister in front of you, you are entitled to the whole Cabinet, and I apologise for being the Junior Minister. After all, that is not my only fault.

"Particularly with Mr. Stanley present we can recall that when you are travelling on the extraordinary construction known as the subway in New York it is as well, besides having a greenback dollar bill, to have a few smaller coins, in fact a few nickels, and it is not a bad motto in life, except that there is one word wrong in the sentence and that is the word 'few.' Nickel, of course, is purely a nickname. When the Swedish mineralogist, Axel von Cronstedt, discovered a copper coloured ore it was called niccolite. You all know, of course, that kupfernickel means in the German language that coppery-looking sub- stance which, when you test it out in the laboratory, is a sham, because it has not got any copper in it. You used as nickel simply the old German expression for the demon of Mischief, which conveys with it an appearance of truth and really has not any truth in it.

"The Chinese used niccolite for a great length of time before it was known as a separate metal, and nickel was only discovered by a man who was looking for something delectable and found something different. I am sure I need not give examples, mischievous or otherwise, of the truth of that statement.

"Now, of course, the fact that we are celebrating a centenary does not mean that any of the ancestors of the Wiggin family are related to Old Nick. On the other hand, I think the whole Wiggin family—Sir Harry Wiggin, who used to be in the House for so long, and his distinguished descendants who are with us to-day, have all been an unmitigated blessing to this great Midland metropolis.

"It has been rightly said that the expansion of the consumption of nickel does not merely mean that there has been some expansion of armaments in some parts of the world. By far the greater increase in the use of nickel has been due to hard-headed ruffians like Sir Herbert Austin, who have used it so much in the motor-car industry, and I at once, as a Government representative, pay tribute to the enormous peace use of the metal nickel in connection with motor cars and a thousand other uses.

"Now, Sir, it is not everybody that can run a mile, but there are a fair number who can stump a quarter, and we are dealing to-day with the centenary of great works that were started under conditions which, if they were not familiar to you, have been for the purpose of greater inaccuracy reduced to print.

"Trade and industry, generally, fortunately contains many most encouraging features. Some of you will have read the Chancellor of the Exchequer's speech at the Bankers' Dinner last night. He expressed in cautious but optimistic language much that is felt by everybody; that this country has much to be thankful for, and that it looks upon the last four years of industrial recovery with profound thankfulness, and with a determination to see that nothing, electoral or otherwise, shall take away from the country the prospect of that recovery continuing. You don't recover except by the laborious and painstaking business of dealing with industry after industry, one at a time, with the task that is nearest to your hand.

"I would commend to you the observations of the Chairman of a great company whose report appears in the Press of to-day. 'A growing number of industries have been able to flourish by selling their products to-day at prices which a few years ago would have been impossible. Do not have too much harking back to pre-war, or even to 1929. The essential task of industry is to provide for the satisfaction of present wants and new wants as they arise. Continue to stimulate the purchasing power of the great mass of the wage-earning families, and look forward to the future with confidence.'

"Those are sound words, and with regard to primary commodities T would only say this. It is, in the opinion of His Majesty's Government, an anomalous position that you should expect the producer of the primary products to sell at cost, or below, to a consumer who pays very large dividends at the end of the financial year. That is not a. wise system, or a wise economy, and efforts will be directed to see that there is a more equitably balanced economy, under which even the much-maligned producer of the raw material and the primary product, agricultural or otherwise, receives a fair reward for his labour and his endeavour.

"This country in the last few years has passed, as you all know, from being a dumping ground into which other countries could turn their goods, into one which held up to auction the right of entry to its own market. But we have not done so with a wall of undue height. We have not done so with a wall which admitted of no doors through which special commodities could pass. We have endeavoured to have a policy of tariff regulation, administered with moderation, with fairness to producing, consuming and merchanting interests alike, and endeavouring to avoid all those attributes which were prophesied as being essential to any conception of tariff reform. The policy of moderation, with free entry for Dominion produce, has produced the stability under the experience of which we are meeting to-day.

"I should indeed be a churl if at a centenary luncheon of this kind, graced by magnificent gifts from the Board of the great Company under whose auspices we have gathered, I did not pay a special tribute, not to the mushroom growth of the industry which, in itself, has a place in international economy and is welcome, but to the old-established names of this country which, through Victoria's reign, through the Crimea, the Indian Mutiny, the South African War, during the whole reign of King Edward the Seventh, and now through His Majesty's Jubilee period, have managed by skill and foresight to adapt their works from time to time, to retain the good fortune, the goodwill of their workpeople, to accommodate their output, to increase their salesmanship, to continue to exist and, even more, to flourish, Those are great attributes, and it is right and proper that now and again seniority should have its tribute for seniority's sake. In a time when we welcome all expansion and all growth we have a specially tender spot for those who continue to survive over a long period.

"Nickel may be a nickname, and I remember that nicknames are rather like whippings: once they have been applied they are singularly difficult to have their effects taken away. You rejoice in your little demon that transfers the copper colour to the lustre and shine of the metal in which you now indulge. There is something of that brightness, something of that universality of use, in British industry as a whole. I shall ask you in a moment to rise and be upstanding to drink this toast and to couple with it two names.

"The first is Sir Felix Pole, who is known from one extremity—I dare not say from one pole—to another, who comes to our Advisory Council of the Board of Trade and pours out units and all sorts of awful things, tells us how heavy orders have increased, how light orders have varied, and the units of production have gone up, and the grid is looking better. (Still, I remember that with forty feet of copper wire and a couple of stones I can produce a short-circuit.) I am privileged to be allowed to couple with this toast, also, Mr. Robert C, Stanley, your President, who is equally well at home when planting his foot on a different desk, whether in the United States, in Thames House, or at this luncheon table. He has all the attributes of an international traveller, all the attributes of a great business man, and above all, he has a personal charm which, at the moment of the distribution of watches to those who have twenty-five or forty years of service, enables even those who have a watch that won't go to say 'Thank you' at the end of the proceedings. The toast is that of 'Trade and Industry,' coupled with the names of electricity and nickel, Sir Felix Pole and Mr. Stanley."

In reply, Sir Felix J. C. Pole said:

"We have listened to a very brilliant speech by the Parliamentary Secretary to the Board of Trade, but I think just at the end he was not quite up to the latest move of the Department, because this morning T received my dismissal from the Board of Trade Advisory Committee. However, that is quite in order, because the three years' period has expired.

"I think I am very specially favoured in coming here to join in the celebrations of to-day, and to offer my very sincere congratulations to this great firm of Henry Wiggin & Company. I think it is a wonderful thing for a trading concern to reach its centenary, and I do most sincerely congratulate them on having done so.

"With this hundred years behind us, one is tempted to institute a comparison between the conditions of a hundred years ago and those of to-day, but in an afternoon gathering of this kind, speeches must be limited in time. But there are two points I would like to make. First of all, a hundred years ago the country was passing through a very similar period to the period we have been passing through recently. There was, for that period, a tremendous accumulation of debt. There was grave unemployment and lack of work. I have an old book of 1833 which contains this sentence: 'The country has reached a condition no longer to be trifled with. The schools of the economists have had their day.' They seem to have come back, The first of the two points to which I wanted to refer is that conditions of employment were obviously vastly inferior to what they are to-day—vastly inferior. Hours would not bear talking about, and wages were hardly worthy of the name. Now we have vastly improved in that respect, but there is this further comparison that a hundred years ago prosperity was achieved by the adoption of Free Trade, plus, of course, mechanisation, steam and all the rest of it. Still, T am going to suggest to you that Free Trade was the turning point. I am also going to suggest to you that now the turning point will be the adoption in this country of Protection.

"It is quite true that the policy is one of reasoned Protection, not a wall that is impassable. We have got Protection now, and I think it has already proved to be, and will still further prove to be, a good thing for us. But I would describe the condition of prosperity at the moment as conditional. One can see some little time ahead. I regard as hopeful the fact that we are thinking of our problems, and that we are facing them.

"If | may digress for a moment, it reminds me of a true story about a former General Manager of the Great Western Railway. He and his associates went to America and had a very good time. He was not very good at making reports, and procrastinated until one Board day he was again pressed for his report, when he expounded the whole thing, and finished up by saying 'We saw many things which were calculated to make us think,' The Chairman looked at the other members of the Board and said 'Well, gentlemen, you have heard what the General Manager has said, and I think you will agree that if by the expenditure of £2,000 we have made our officers think, it is money very well spent.'

"We are thinking, and it is a very good thing that we are thinking, and T hope that in the process of thinking we shall not change our Government, for one thing. 1 hope we shall stick to that Government, because I am most anxious that we should stick to our policy. Industries which have been established, or which have been expanded, as a result of this Protection policy, must be assured that they are going to have a continuance of that policy, because it is fatal to play fast and loose with industry. That remark applies even to subsidies - I dislike subsidies very much indeed - but where subsidies have been granted, then I say unquestionably it would be wrong hurriedly to withdraw them.

"Dr. Burgin has not said an awful lot about trade. He said it is definitely good and I, as one connected with an industry which has a light side and a heavy side, can say most definitely that things are better. In that connection I would like to say that, of course, we must have export business, and I recognise that in negotiating trade agreements the Government appreciate that we must have export trade, because they are working on the basis that if we buy from a country we also should be able to sell to that country.

"Another thing which is most helpful to industry is the Export Credit Department of the Board of Trade. I can say quite definitely that my own Company has taken over five million pounds worth of export business which they would not have touched without the Exports Credit system. I can add to that, for the benefit of Dr. Burgin, that so far we have not made a bad debt; we are quite good customers of the Department.

"In conclusion I must congratulate Messrs. Wiggin very sincerely indeed, and I say, in a final word, that the electrical industry unquestionably owes them a very deep debt of gratitude, because had it not been for the development of various nickel alloys, the electric heating which is now so general, and is certainly extending, would have been impossible. This is an addition to what our Chairman has said in regard to the use of nickel in the motor industry."

Mr. Robert C. Stanley:

"It has been a matter of deep interest on my annual visits, during the past few years, to observe the progressive changes and steady expansion in business that have taken place in the United Kingdom. In this connection, let me express the hope that the revival of trade to which your Chancellor of the Exchequer paid such an eloquent tribute in his recent Budget speech, may continue unretarded. Based on an interpretation of the usual indices of trade, such as steel ingot production, freight-car loadings, department store sales, and others, I am of the opinion that business both in Canada and in the United States is showing marked improvement.

"As a minor index of world trade, the business of The International Nickel Company, whose activities are widely diversified, touched bottom in the spring of 1932, and since that time, I am glad to say, has made steady progress.

"It seems paradoxical that we should be celebrating the centenary of a Company which was established some fifty years before the discovery of the vast nickel deposits in Canada, but for which the industry would possibly have remained undeveloped.

"Let me first outline briefly the early history of the business of Henry Wiggin & Company. It was founded by Mr. Brooke Evans and Mr. Charles Askin, following the experimental production by Mr. Askin of an alloy known then, and for many years afterwards, as 'German silver'-—now called nickel silver. Thus was laid in the City of Birmingham the foundation of an important British industry.

"This Company's claim to a permanent place in the history of metallurgical development, however, is not based upon the production of this alloy, but on the discovery made by Askin a few years after the founding of the Company of a method for effecting the separation of the metallic elements—nickel and cobalt. In the early part of the nineteenth century these were relatively unknown metals, and apart from the use of nickel on a small scale in electro-plating, and the use of cobalt on an equally small scale in the colouring of pottery, little was known either of the properties of these elements or of the methods of refiningthem.

"I would like here to call attention to the fact that the man chiefly responsible for the success of the Wiggin enterprise, Sir Henry Wiggin, was not only a pioneer of a highly specialised industry but a public-spirited citizen who rendered conspicuous service to Birmingham. Sir Henry was, during a period approaching fifty years, the head of this Company, and was successively a member of the Town Council, Mayor and a. greatly respected leader of philanthropic, educational and social activities. He finally entered Parliament as a Member for one of the largest industrial constituencies in England. Thus, in celebrating this centenary, we desire to honour the memory of one who was not only a great industrialist but a great citizen as well.

"1 am delighted to say that we have with us to-day members of the Wiggin family, who formerly took a close personal intcrest in the management of the business, that is, prior to its absorption by the Mond Nickel Company some fifteen years ago. They must feel a sense of gratification at being present to celebrate the hundredth anniversary of the Company organised by their ancestor. We are pleased to note the presence of Mr. James Rollason, who was also for some years a Director.

"It is moreover a source of pleasure to welcome descendants of the founders of the Mond Company, Sir Robert Mond, Lord Melchett and Mr. Emile Mond, and Mr. Robert Mathias. It is fitting that J should here allude, with deep regret, to the recent death of Dr. Carl Langer, a Director of the Mond Company since its beginning, and whose contributions to science and chemical engineering played such an important role in the development of an industry.

"From the inception of the British nickel industry in this city, there has grown by stages the International Nickel Company of Canada, now truly an international organisation, both from the standpoint of its world trade and the international ownership of its securities, Nevertheless, it is an Empire Company due to its possession of vast mineral resources in the Dominion of Canada and because the larger proportion of its securities is held by citizens of the British Empire.

"In this connection, may I point out a fact, which again may seem paradoxical, that although the Wiggin Company has been in existence for a century, one should realise that the present nickel business, embracing the widely diversified commercial use of the metal, started virtually as a new industry shortly after the close of the War. This young industry has thrived, and is thriving, due largely, in my opinion, to the Company's well-established policy of employing technical research and development to extend the uses of its products.

"It is perhaps therefore appropriate for me to announce to-day our decision to expand our research facilities by the erection in this city of what we think will be one of the best-equipped laboratories of its kind in the country, thus not only providing additional means for solving our own constantly recurring problems, but placing us in a position to render further aid to consumers of nickel.

"In considering the future of the industry, which, I have explained to you, is new in its character and scope, an interesting point may be mentioned which has an important bearing on the rate of increase in consumption of nickel as compared with other non-ferrous metals. Copper and certain other metals, the history of which may be said to go back to prehistoric age, are well nigh indestructible, and do not wholly disappear after they are used. It is therefore obvious that in the case of metals which have been in common usage for centuries the consumption of virgin metal must be greatly influenced by the quantity of scrap metal returned as a result of obsolescence. Nickel, however, being a metal brought only recently into general use, has not as yet and will not, in my judgment, for a considerable period of time be affected to anything like the same extent by this reversion of scrap as are the older metals. I think, therefore, I am justified in saying that there is indicated a probable continuation of the present relative rate of increase in the consumption of nickel—at least for some time to come.

"Just as the business of Wiggin has participated in the general policy of the parent Company of expending large sums of money for equipping and modernising its plants wherever situated, so too has the Company shared in the benefits of that policy. But such a programme could not be successfully accomplished without the whole-hearted and efficient co-operation of the organisation as a whole. So long as team-work of this character exists in industry we are assured of the continued success of our companies.

"In conclusion, let me leave one thought with you, which I believe to be of paramount importance to both 'Trade and Industry.' We of the nickel industry, in common with other industries, look upon war as a serious threat to the orderly and successful development of our respective enterprises.

"During the past fifteen years the company which I represent has devoted a great amount of time, energy and money in developing applications for nickel in the fields of transportation, communication and manufactures. As a result it has already established important markets, it expects to increase these markets, and furthermore to continue to develop new markets.

"Thus it is apparent that the recovery of 'Trade and Industry' from the disorganisation and chaos following the last war, and their future progress as well, depend essentially on the maintenance of world-wide peace.

"I would therefore express the hope that the world may be allowed to progress without such interruptions, and without the necessity for re-adjustments, such as have been experienced during post-war years."

The Rt. Hon. Lord Melchett in proposing "The Guests" said:

"Coupled with the toast of 'The Guests,' I have first the name of Mr. Geoffrey Lloyd, a Member of Parliament for this great city, who is better known to you than he is to me, although he and I have been colleagues for many years. But no one knows a man better than his own constituents. They find out his failings and they appreciate his virtues, and they let him know all about the former and, if they are nice constituents, they let him know about the latter, too. I am quite certain Mr. Geoffrey Lloyd, who is one of the most hard-working Members of Parliament in the House of Commons, will do, and has done, much there to further the interests of his great constituency.

“We also have, as another name coupled with this toast, Colonel Wiggin. We are particularly delighted, always, to have among our guests and to entertain Colonel Wiggin and the members of his family, and personally it gives me great pleasure to couple his name with this toast, because some forty-five years ago my grandfather was a guest of Henry Wiggin & Company. In those days he came down and worked in the works, took over at least one part of the work of Henry Wiggin & Company, and there put up the first experimental large-scale plant of the carbonyl process. It was in those days a discontinuous plant, the work was frightfully difficult and very dangerous. But it was continued under difficult conditions, and ultimately has brought about the success which has contributed to the celebration of to-day, of the great Company under whose auspices the celebration is taking place, and had itself commenced the refining of nickel in earlier years.

“That was the first plant in which a metal existed both in a solid condition and also as a gas, and there is one interesting point in regard to the technical progress that to-day in the same type of plant a metal exists both in a solid condition and as a gas and also as a liquid. I think jt is the only plant in the world in which any substance exists in those three conditions. It shows the strange results that can be obtained by science, the strange benefits which Nature can afford us.

“I want to welcome in my own way another guest, who really is officially no guest at all. But Mr, Stanley comes to this great meeting of Englishmen. Mr. Stanley comes over at least once a year and represents to me, and I think to all of us, a great combination of the English-speaking peoples. The International Nickel Company of Canada, with its enormous properties in Canada and this country, and its works in the United States, is one of the best examples I know of the real rationalisation of a great industry, based on the goodwill, the co-operation and the friendship of the English-speaking peoples. Mr. Stanley’s energy and ability in the conduct of that concern is a thing for which we are all grateful, and which we admire very much. Long may this association continue, and may it develop into a broader and wider association of the English-speaking peoples to the benefit of the world at large and to the continuance of peace and prosperity.

“We are very glad indeed to welcome Colonel Wiggin here again, and he must be proud to think that his family has created an industry which has lasted for a century, even in this country where things last for a long time, a rare distinction. I am glad to think that he and I still have two things in common, besides nickel—banking and fox-hunting - two great British institutions of which you can easily judge which is the more important. With Mr. Geoffrey Lloyd also I have something in common - politics and the Conservative party. Gentlemen, I give you the toast of ‘Our Guests,’ coupled with the names of Mr. Geoffrey Lloyd and Colonel Wiggin.’

In reply, Mr. Geoffrey Lloyd, M.P., said:

“It is my privilege and pleasure, very shortly but very sincerely, to express the thanks of your guests for the truly magnificent entertainment and the hospitality you have given us to-day. I have the honour of representing in Parliament the district in which your works are situated, and I think it stands to reason that anybody who sees those works, and anybody who has a spark of imagination must feel that it is a great honour to represent the district in which such fine works are situated.

“I fecl that I must at once take notice of the announcement which Mr. Stanley made to-day of the institution of this new research laboratory in this city, and to express at once very strongly the gratitude the people of this city will feel for having such a fine institution here. It is of interest, I think, that your Company, which has for some time been one of the leading companies in the application of science to industry, should be taking a further step in that direction.

“I only venture to say one thing, and that is, that yesterday I happened to be having a talk with one who is well known to you, my lord Chairman, whose job it is to be continually studying the general prospects of British industry. I asked him ‘What do you think of the position?” He said he thought it was hopeful. He added something which has a particular reference to your Company, although it applies also to industry as a whole. He said we hear a great deal in these days of the starting-up of manufacturing industries in what he called the backward countries of the world. But, he said, that should not be regarded as a disaster at all, for they are inevitably at present engaged in manufacturing the cruder products, and it is our job to apply research to industry and our existing organisation to manufacture the more complicated and difficult products which they cannot make. And we must bear in mind that the higher purchasing power they attained by engaging in manufacturing should be used for the acquisition of the more-complicated products to which we ought to apply ourselves. Therefore he laid it down that the intensive application of research to British industry was one of the keys to future prosperity, and it is quite clear your Company is giving a lead in that direction, I am not going to keep you any more, except to say I shall be expressing the feelings of all your guests when I say we hope you may go on, not only conducting such a successful enterprise, but continuing to give a lead which is of value for the whole sphere of British manufacturing.”

Lieut.-Colonel W. H. Wiggin, D.S.O., M.C., after offering congratulations and good wishes, said:

“One guest who was invited here to-day, and who unfortunately is prevented from being present by sickness, I must mention by name. That is my uncle, Colonel Walter Wiggin, who entered the business of Henry Wiggin & Company in 1887, forty-eight years ago, and after working for the Company all his business career, was the last member of my family who was the Chairman of the Company until the time of its merging with the Mond Nickel Company. I saw him on Sunday, and he asked me to express his apologies, to wish the Company every prosperity, and to say how dreadfully disappointed he was that he was unable to be here.

“I want to say one very short word on a rather different subject. In the time immediately following the war, when it became quite clear that Henry Wiggin & Company, as it then existed, had not got the resources to undertake the great developments that were so obviously facing the industry, and it came to an arrangement for this merger to take place, we members of the old Board of the old Company felt an anxiety that I think has been felt by many small family businesses when they had to enter into amalgamations and rationalisations of this kind. Our great anxiety was in handing over our own workpeople, many of whom had been with the business for a long time. Not that we really had any doubt as to the treatment they would receive, but there was a very great wrench in losing the personal touch. I think you all understand what I mean when I say that.

“I am very, very happy to be able to pay tribute here to the new conditions under which the firm now exists, and to the relations which still exist between the Board of Directors and the management and the staff. The old workpeople have been treated most generously throughout, and a ceremony took place yesterday at the Wiggin Street works, which I truly should have liked to have attended but was prevented by business in London, when presentations were made by the Directors to all old employees of twenty-five years’ service and over, of whom I believe there were some eighty in number. I also should like the guests on this occasion to know that the International Nickel Company, and the Mond Nickel Company, have also embraced the employees of the subsidiary company in their very generous pension scheme.

“Those things, gentlemen, are a very great help, and it is the relations that exist between the management and workmen in British industry that goes so far to make for its success in these difficult times,”

Mr. D. Owen Evans, M-P., in proposing the health of the Chairman, said:

“I may let you into a Little secret before I formally propose the toast. We have heard the word centenary used to-day by several speakers. I may tell you Mr. Stanley and myself for some weeks have endeavoured to decide how to pronounce that word, and we have heard to-day a distinguished Scotsman from the chair pronounce it in an altogether different way from what we should have pronounced it. We decided that, according to the proper English way, it would be ‘centennery,’ and I am glad to see that Colonel Wiggin has endorsed that opinion just now. But a Scotsman, of course, has a right to pronounce it any way he likes and, if I may say so, if we as members of my small nation had to decide how to pronounce it we should have said a very different thing indeed. We should have pronounced it ‘kentenary.” You may choose what you like.

“Well, gentlemen, it needs no words of mine to propose the toast of our distinguished Chairman. It would be superfluous indeed for me to elaborate upon any matter connected with him. It is fitting that he should be Chairman to-day because, not only by reason of his national and even international reputation, but because he has been associated with the nickel industry for so many years. He has been a director for a long period of the International Nickel Company of Canada, the parent company, and he now is the Chairman of the British Advisory Committee of that Company. We know that he has been active and valuable in his support of the nickel industry, because he was the guide for introducing into this country what we now call Monel Metal.

“Well, I am not going to advertise that metal to-day. That is very properly and very extensively advertised already. He has always, during the years in which I have been associated with him, been the means of guiding and advising the Nickel Company in all matters of a very complex character. Not only that, but our distinguished Chairman has a national reputation and even an international reputation. His services during the War were notable and valuable in the extreme.

“From being Scottish Director of Munitions he was raised by very rapid stages to be Secretary of State for Air, and in that respect the country must be very grateful to him. He has by his work and ability justified the honour, if it be an honour, and I believe he considers it an honour, of presiding over this distinguished gathering to-day. We are celebrating a centenary (I am pronouncing it now in the English way), but I am very glad to realise that it is not the centenary of our Chairman. I understand from the records and the reports in the Reference Library that he has scored already fifty, and is still not out, and from his appearance to-day and his wide activities he is likely to remain not out for many years more, and it would take a great deal of slow and fast and body-line bowling to knock his wicket down. I think I am expressing the wishes of all of you when I say that we desire him to have a long life of prosperity and of happiness, in order to give him the opportunity to be of still greater service not only to this industry but to the nation as a whole. I ask you to drink to the health of our Chairman.”

The Chairman, in reply:

“There are at least three separate and independent reasons why I should be short. First of all, you have still a programme in front of you. Secondly, if I go on, I shall make some more mistakes in pronunciation. The third reason I think I can only illustrate by a personal experience. I think it happened the last time I went to New York. I went to my hotel. I wanted to speak on the telephone. I lifted the instrument. I gave a number which the lady at the other end acknowledged by repeating it, and I said ‘Thank you.’ She said ‘Cut out the thanks. It only disturbs the operator.’ With the vote of thanks so kindly proposed by Mr. Evans, and so cordially received by you all, I feel definitely disturbed, and I simply thank you very much.”